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Volume XI, No. 1 **JANUARY, 1926** **Price, 35 Cents**

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Motorship

ILLUSTRATIONS of the newest designs in international merchant motorship and Diesel-engine construction and auxiliary equipment.

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Vol. XI JANUARY, 1926 No. 1

Carl Fisher's Speedy Yacht Shadow K

With Diesel Engines of 1000 s.hp. This 150 ft. Motoryacht Has Attained a Speed in Excess of 19 Miles Per Hour in Trials Over a Measured Course

AN ARDENT devotee of speed, Carl Fisher, generally regarded as the biggest individual factor in the development of Miami, Fla., has broken with the tradition that Diesel-engined yachts could have only a moderate speed because of the weight of their machinery. In placing his order for a 150 ft. Diesel engined yacht, with machinery of 1000 b.hp., he expressed the thought that weight should be saved in both hull and engine in order that a speed near to 20 miles per hour could be attained.

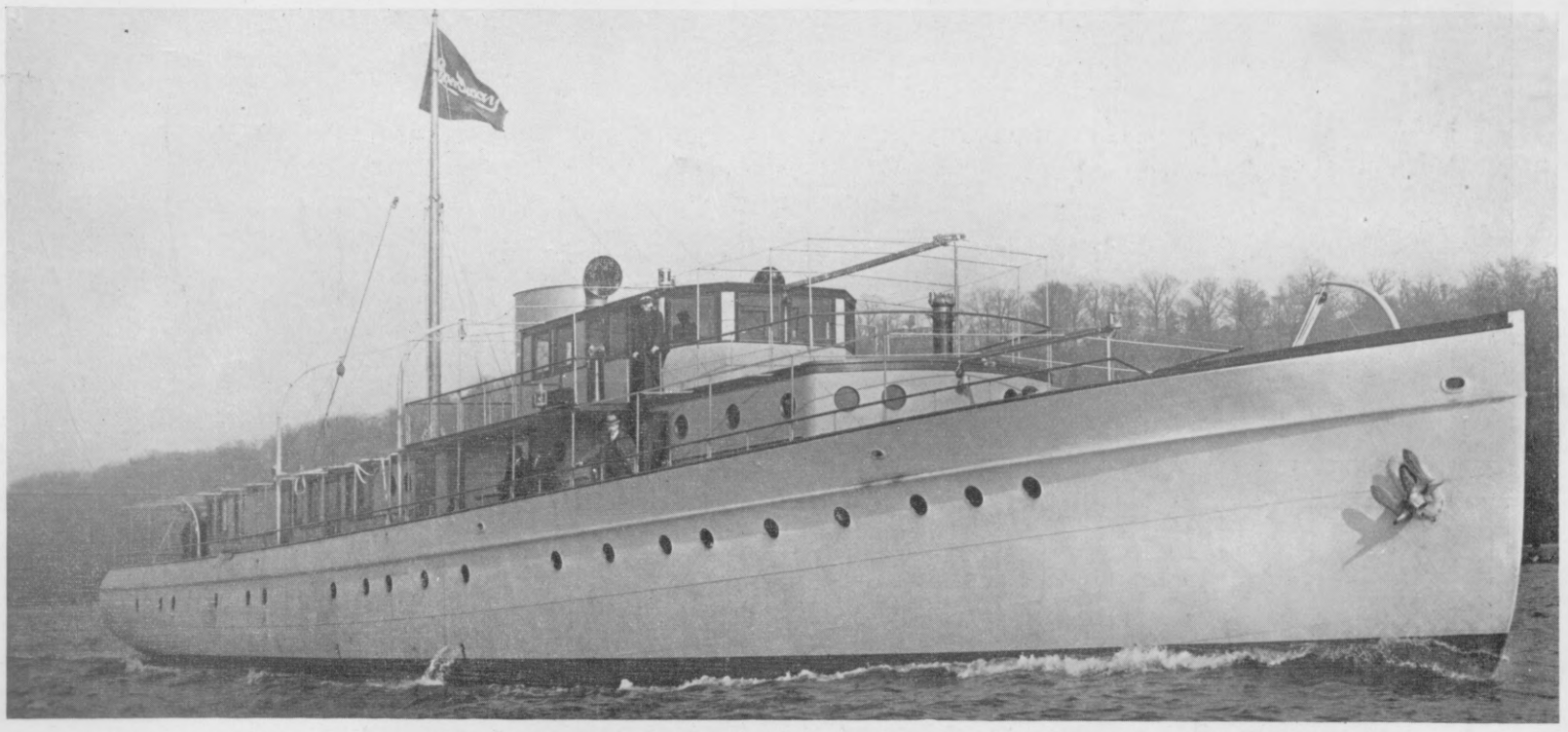
SHADOW K is the name of the new boat, the letter K indicating that she is the eleventh boat of the SHADOW series which he has owned. She was completed last month by the Consolidated Shipbuilding Corp. of Morris Heights, New York, and left for the South about the end of the year. Designed by the Purdy Boat Co. of Port Washington, L. I., she has speedier looking lines than are generally shown in Diesel yachts. Her scantlings and plating are very light, and there can be no two opinions about her speed having been obtained at the expense of sturdiness.

Measuring 150 ft. overall she has a beam of 25 ft. and draws 8 ft. of water. The illustration on this page shows her before the stores were loaded and not therefore down to her load waterline. Her graceful lines do not show to advantage in the picture. She has a very pleasing sheer and a curved transom, which is quite unusual in yachts of this size and not displeasing. In the deck house the forward space is given up to a dining room, with galley and pantry adjoining and separating it from the engine room casing. In the after part is a commodious owner's stateroom with bathroom and toilet adjoining and with stairway to the guests' quarters below. The owner's room extends the full width of the deck house and is provided with a large bed instead of with berths, and contains also a tile fireplace. It connects with a small guest stateroom just forward of it provided with berth, separate washroom and toilet. At the foot of the staircase on the port side is a small lounge. Above the deck house are the pilot house, chart room and captain's stateroom. The accommodation for the engineers and crew is forward of the engine space and is as commodious as the guests' quarters.

In the engineroom there has been no

40 m.p.h. Diesel Yacht

Carl Fisher of Sands Point, L. I., and Miami, Fla., has ordered a motor yacht of 160 ft. length with a speed of 40 miles per hour. She is to be equipped with a pair of Diesel engines developing an aggregate of 6000 s.hp at their full speed. The engines will be of the V-type with 12 cylinders each, measuring 17 in. by 17 in. At full power they will turn at 700 r.p.m. The design and construction of the boat has been entrusted to the Purdy Boat Co. of Port Washington, L. I., and the order for the machinery has been placed with the Bessemer Gas Engine Co. at Grove City, Pa.



Shadow K, the fast Diesel-engined yacht recently completed for Carl Fisher, pictured on the day she ran her speed trials

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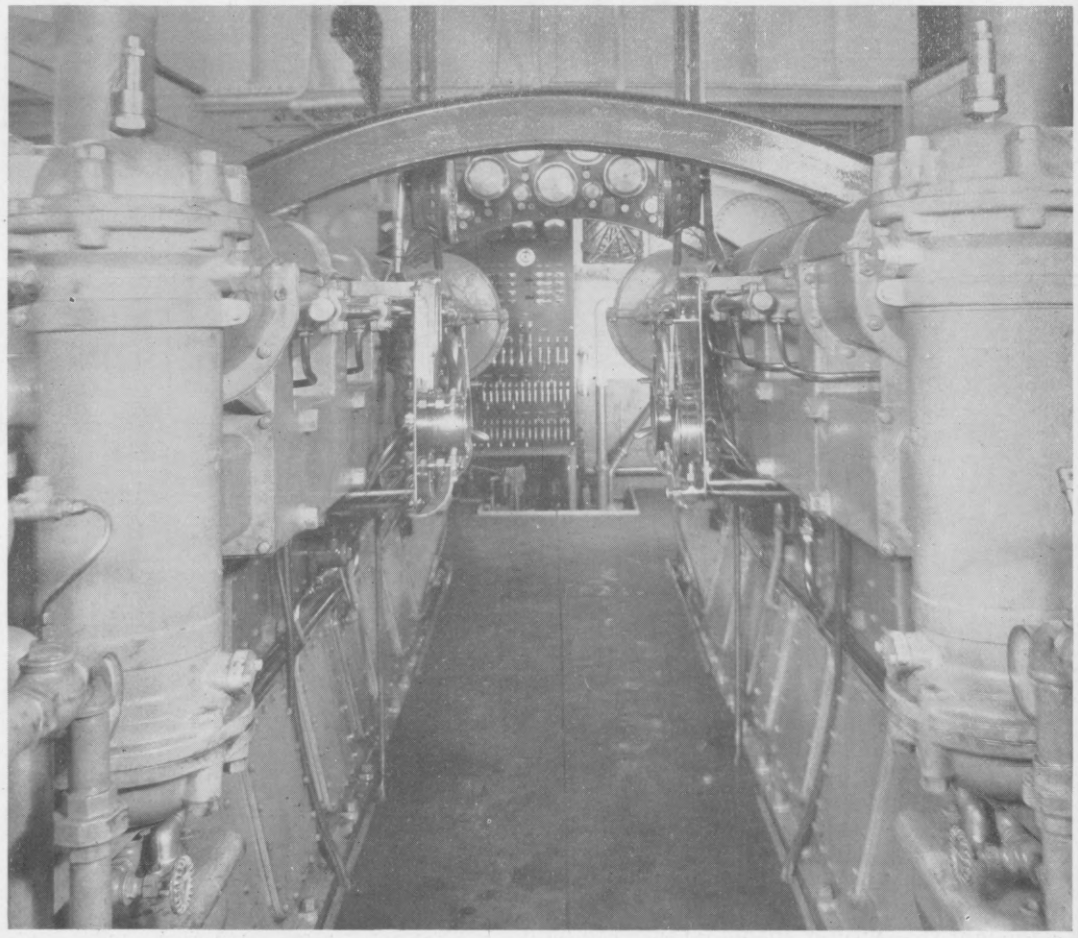
cramping, reasonably free space being left around the main engines and around all the auxiliaries. The engineroom extends the full width of the ship and is separated from the accommodation forward and aft by two cofferdams, in which are located the oil tanks with a fuel capacity for 5000 miles endurance.

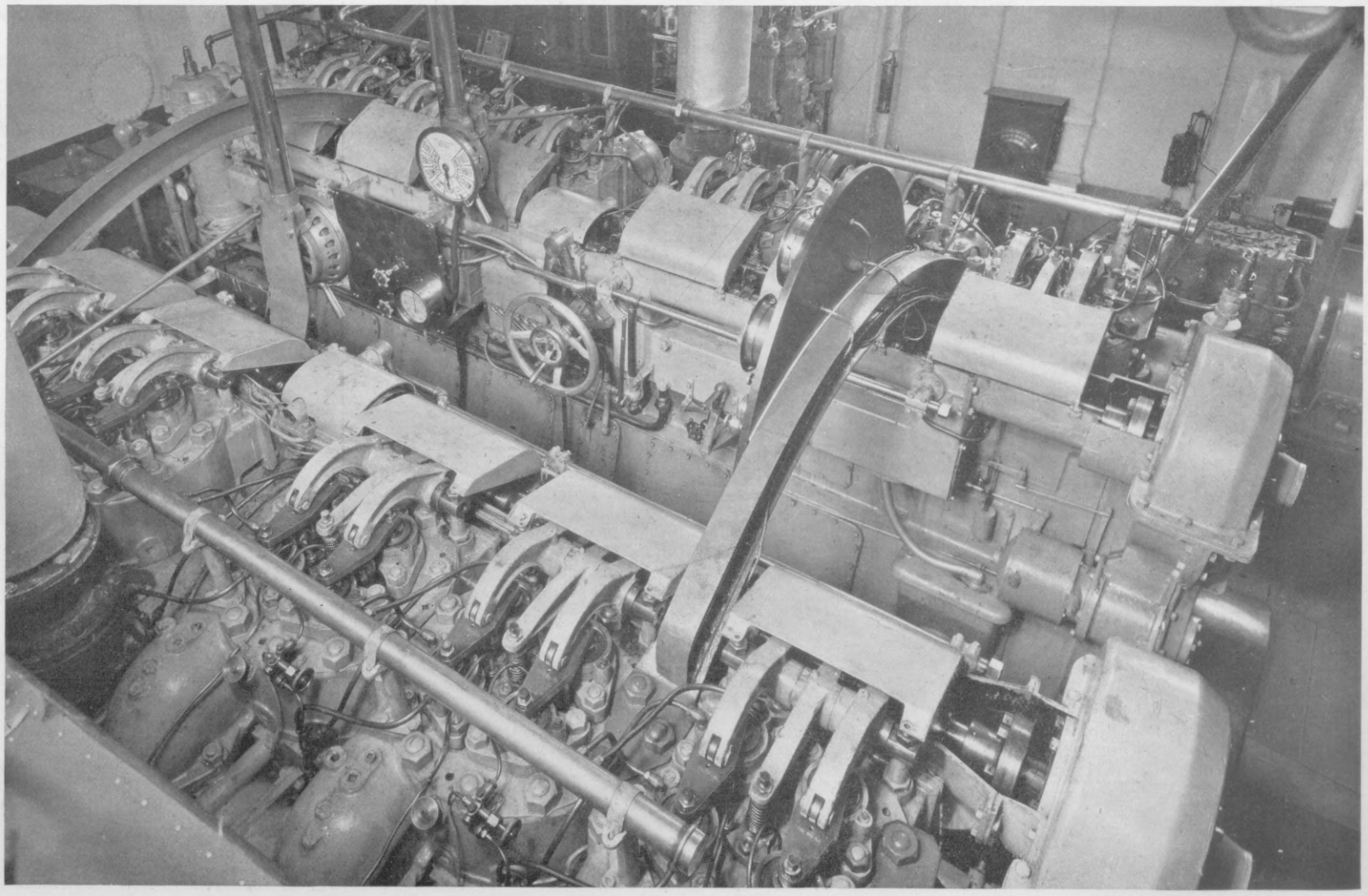
The main engines are of the new six-cylinder 500 hp. Winton type and have the same general characteristics as the model 111 described in the April issue of MOTORSHIP. They have cylinders of 14 in. diameter and with a piston stroke of 15 in. Turning at 425 r.p.m. they develop 500 s.hp. each.

By careful attention to details of design, by the judicious lightening of parts from which metal could be spared and by the use of aluminum for covers or shields not subject to strain, the weight of the 500 hp. engine has been reduced to about 20 tons or about 80 lb. per s.hp. For the bedplate a single casting is used, above which is bolted a single piece engine frame surmounted by a cylinder block casting in which all six cylinders are fitted. This makes a very stiff engine construction which in combination with a large sized crankshaft and lightened reciprocating masses accounts for a smoother running than ordinarily expected with an engine speed of 425 r.p.m.

In the cylinder heads of this engine the practice which Winton has followed for so many years in the larger high-speed engines with regard to duplicate inlet valves and exhaust valves is continued. Unlike former Winton practice, however, these valves are now contained in separate cages. This valve duplication is, of course, designed to provide larger valve areas than could be obtained with single valves. The method of operation shows very clearly in the accompanying picture taken from the grating in the SHADOW K's engineroom and looking down on her main engines. There is a



Looking aft between the two 500 s.hp. engines of Shadow K



Top of the Shadow K's main engines as seen when one looks towards the forward starboard corner of the engine room

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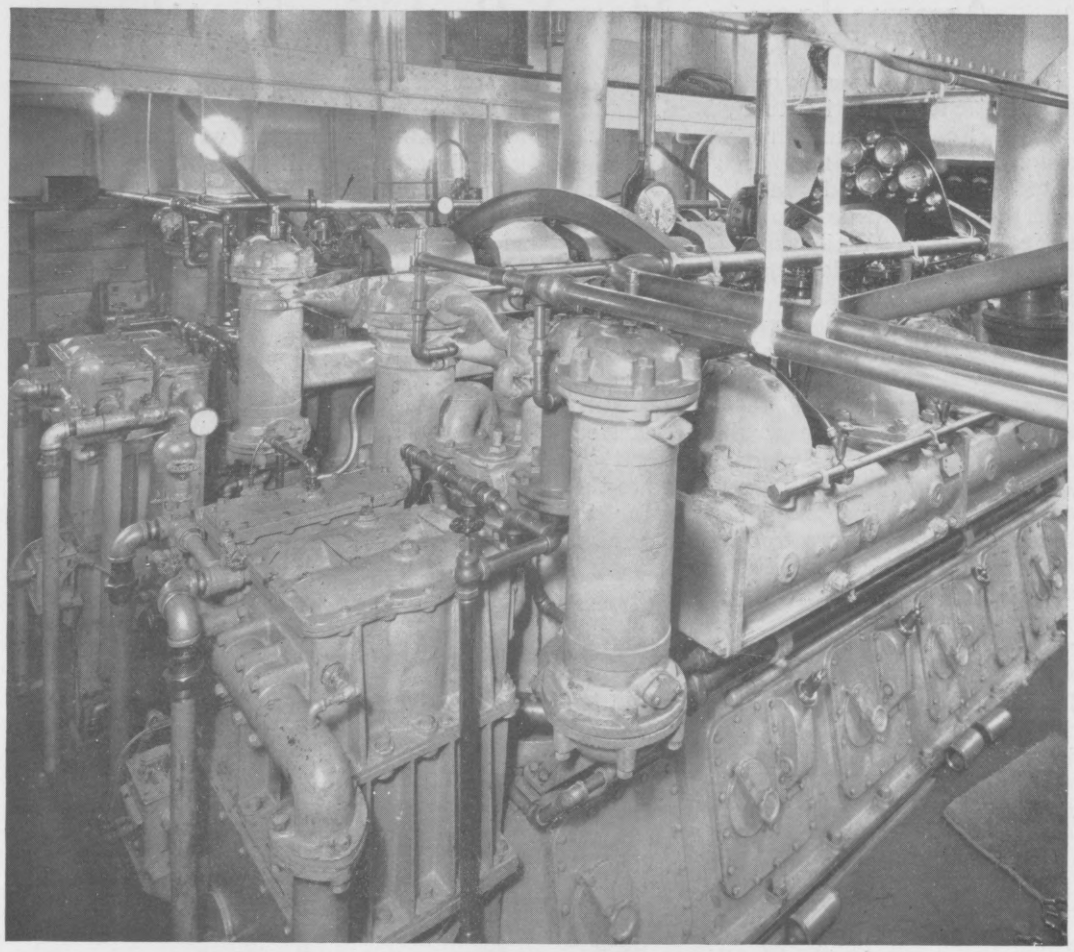


Forward end of the engines, showing the water and oil pumps

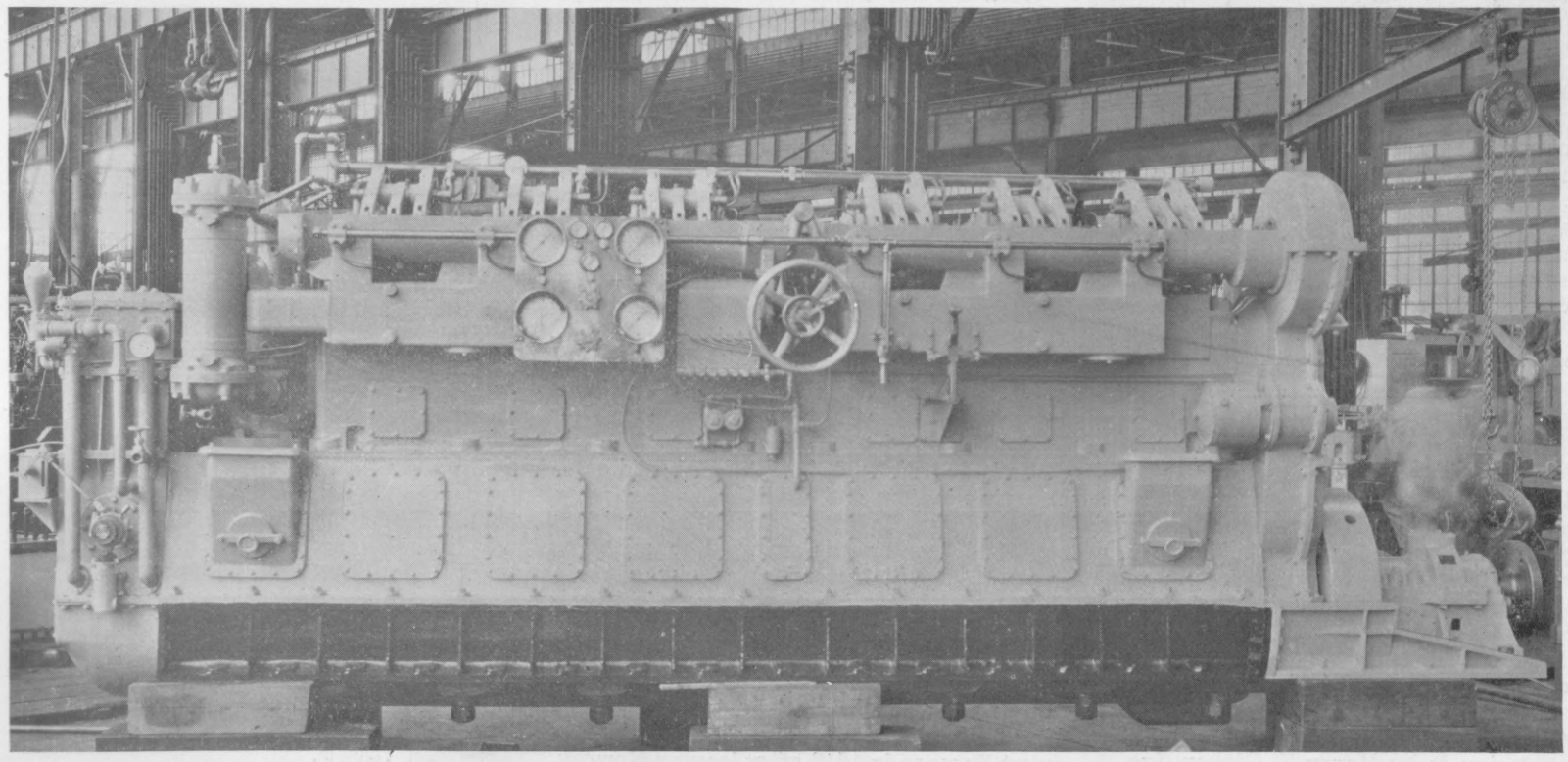
plain yoke between each pair of valves, and the roller of the respective valve rocker bears on the middle of the yoke, opening both valves simultaneously. The exhaust valve cages are individually watercooled. In the middle of the head is the downward opening fuel injection valve, and the starting valve is on the side.

At the back of the engine the exhaust elbows are connected to a watercooled manifold, from the middle of which a covered 8 in. exhaust pipe leads straight up to join an uncooled flexible 8 in. exhaust pipe connected with the mufflers in the stack. On the front of the engines the air intakes connect with air manifolds provided with muffled suctions. These air manifolds support the troughs in which the camshaft bearings are carried. Forced lubrication is supplied to the camshaft, and the oil issuing from the bearings falls into the trough and is led back to the sump. Hinged aluminum covers extending over the inboard ends of the valve rocker arms and covering the cams prevent oil from being thrown off the revolving shaft. These covers, like many of the other engine fittings that have no stresses to withstand, are made of aluminum. As in all Winton engines the adjoining astern and ahead cams for each valve are tapered together in order to permit the camshaft to be moved endwise for reversing without the valve rockers being lifted. The camshaft gearing is at the after end of the engine.

On the forward end of the engine is the 3-stage compressor furnishing air for fuel injection and for maneuvering. The interstage and final coolers are external to the compressor and thus rendered very accessible for inspection and cleaning. Forward of the compressor crankthrow there is a cross shaft, geared down from the crankshaft and serving to drive the oil and water pumps, which are both of the reciprocating type and operate at reduced speeds. The oil pump feeds the lubricating oil circuits at about 15 lb. pressure and supplies every part of the engine, with the exception of the compressor, for which there is a separate mechanical lubricator permitting a fine adjustment of the lubricating oil feed to those parts.

In these engines the control stand is at the middle front, where the fuel pumps also are located. No direct control is provided for the fuel feed, the regulation of speed being obtained by controlling the speed governor which acts directly on the fuel pumps.

In the various engineroom pictures accompanying this article arches of H section material are seen between the two engines. These are braces which have been added since the first trials were run, when the engine beds showed themselves to be too light, being of the same reduced scantlings as the rest of the hull construction. Outboard of the engines, both forward and aft, ties have also been fitted between the tops of the engines and the nearest hull frame. Recourse has previously been had to similar methods of bracing in other yachts where



Side view of one of the 500 s.hp. main engines for the Shadow K assembled in the factory for test and shipment

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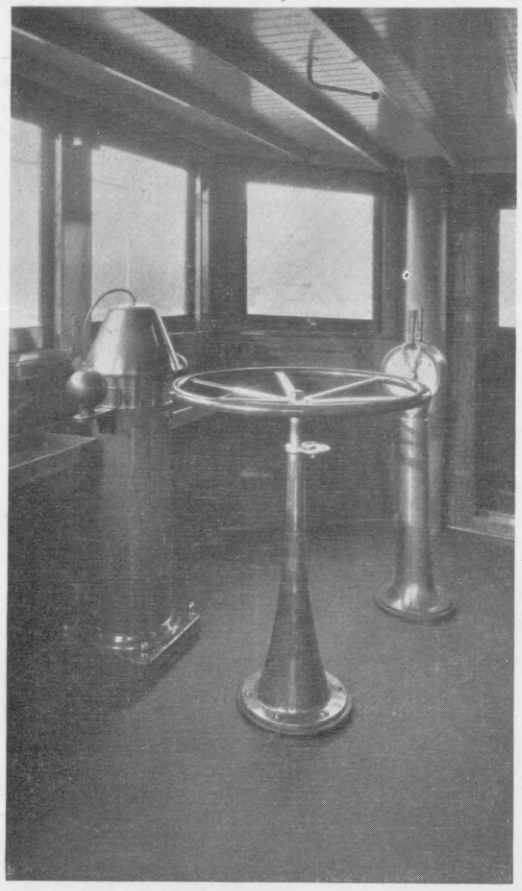
the engine beds showed themselves too light. However much hull scantlings are cut down, the temptation to reduce the weight of the engine girders should always be resisted.

For auxiliary purposes there are three 7½ kw. generator sets, each driven by a six-cylinder Winton gasoline engine. There is also an auxiliary compressor driven by a 10 hp. electric motor, the compressor of which is of the same type and size as fitted to the Winton model No. 105. The electrically driven pumps comprise the fuel transfer pump, two American Machine & Foundry rotary bilge and fire pumps, and two Delco plunger style water service pumps driven by electric motors through reduction gearing. All the electrical machinery is of the Westinghouse type except on the Delco pumps. There is one other little pump in the engineroom, an automatic air



Shadow K's horizontal steering wheel

pump made by the Kellogg Mfg. Co. of Rochester, maintaining a pressure of 30 lbs. It is driven by a ¼ hp. electric motor. In various parts of the ship there are three Frigidaire ice machines electrically operated. This type of ice machine is a great convenience in small vessels because it removes all the bother of finding ice ashore and getting it aboard.

D. C. Whitney's Yacht

A yacht of 160 ft. overall length and with 840 hp. is under construction at the Brooklyn yard of the Todd Drydock Engineering & Repair Corp., for D. C. Whitney of Detroit, Mich. She will measure 152 ft. on the waterline, 26 ft. molded beam and will draw 12 ft. of water. Her machinery installation will consist of two 6-cylinder Bessemer engines, each developing 420 hp. at 250 r.p.m., and two Bessemer generating sets of 30 kw. each for auxiliary purposes. Her design is by Henry J. Gielow, Inc.

Amundsen's Maud Back in Seattle

AFTER three years of battling with Arctic ice floes, the sturdy M. S. MAUD, Captain Roald Amundsen's world-famous exploration ship, is now back in Seattle, from where she sailed June 3, 1922, in the hope of drifting across the North Pole with the ice currents. While she did not succeed in her primary mission, the MAUD enabled the scientists on board to make important researches and to collect valuable data.

When the MAUD left Seattle in 1922 she was provisioned for a voyage of seven years. Her owner hoped that by cruising into the Polar ice she would be carried northward across the Polar Sea. Instead it was found that the drift was more to the westward, carrying the ship as far as Koteinoi, 2500 miles west of Nome, Alaska. When all hope for her drifting northward was seen to be futile, her owner ordered her return.

The journey was not a particularly hard one, according to members of the crew. The MAUD had been amply and well provisioned, and at no time was there any danger of a food shortage. Officers and crew returned to Seattle in fine spirits, glad to be back to civilization. The coldest weather experienced was 84 deg. below zero, and at only one time was the schooner in any danger. This was when she was gripped in a wedge-shaped section of ice which lifted her bodily 20 ft. and threatened to crush the vessel.

While the days were sometimes a bit monotonous, there were many bright incidents. Fresh meat was obtained by killing polar bears. One of the most novel experiences was the clear reception of music from American and English broadcasting stations over the MAUD'S radio. The reception was reported to have been very distinct during the long winter nights and furnished welcome diversion for the men, otherwise so utterly cut off from the civilized world.

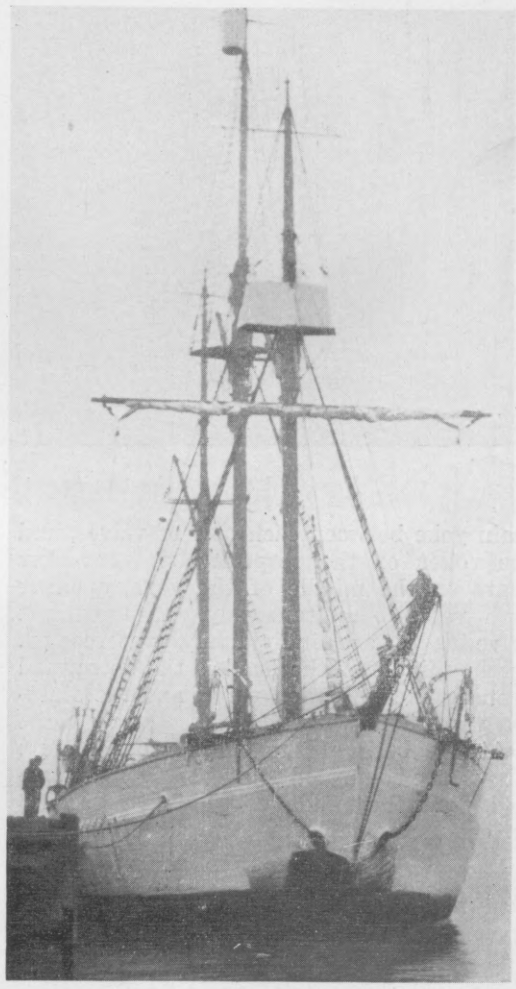
The airplane carried on the MAUD, with which a Polar flight was to have been attempted, was wrecked on the ice after two short expeditions. The MAUD was commanded by Capt. Oscal Wisting. With him was Dr. H. N. Sverdrup, in charge of the scientific observations, assisted by F. Malmgren, Lieut. O. Ondal and Lieut. U. Dahl. These men are very reluctant to say much about their investigations, but it is known that important meteorological and magnetic observations were made.

The MAUD herself is a remarkable vessel. Designed by Capt. Amundsen himself and built in Norway, she embodies every convenience and protective device her owner's many years of Arctic exploration have taught. Although she is 120 ft. long, her beam is a full 42 ft. and her draft 16 ft. She is so constructed, with her broad easy-curving bottom and special keel, that when pinched by the ice she is lifted and not crushed by the pressure. Her propeller may be lifted through a pit by a chain hoist, which was intended for use in installing new wheels in case of accident.

The vessel is sturdily built of oak and up to her deck-line has a thick, extra sheath of oak covered by still another sheath of ironbark. When she negotiated the Northwest Passage in 1918 after leaving Norway, this construction demonstrated its fitness for Arctic service.

The MAUD is powered with a Bolinder 4-cylinder 240 hp. oil engine turning 240 r.p.m. Fuel oil is carried in 21 tanks below decks, with a total capacity of 100 tons, and in six deck tanks with a total capacity of 24 tons. She has a 15 hp. Bolinder engine for the anchor winch and a ¼ kw. Delco lighting plant.

Captain Amundsen has been a consistent patron of oil engines for over 20 years. In his little 80-ton GJOA, which was his home for five years, when he first made the Northwest Passage, he had an 80-hp. oil engine.



Maud after arrival at Seattle

Responsibility of Exporters

Chairman O'Connor of the Shipping Board hit back hard at the American Manufacturers' Export Association last month for the vacuous resolution passed at its annual general meeting to the effect that the Government should sell its ships to private operators. When O'Connor protested against the fatuity of the resolution he was invited to argue his case before the members. "Show me your private operators," was the substance of his address, "we want to sell the ships, but find nobody to buy them." He also took the exporters to task for their non-support of American shipping. To the credit of the A.M.E.A. let it be added that a committee was formed to examine how the membership of the Association could give most effective support to American vessels.

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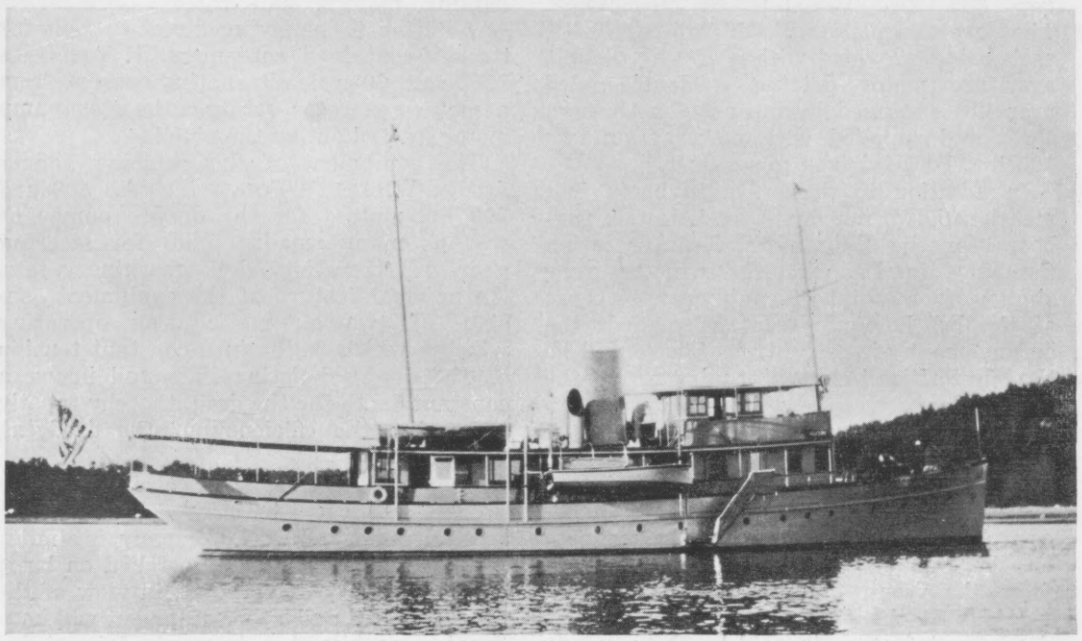
G. W. C. Drexel's Diesel Yacht Alcedo

A Roomy 108 ft. Twin Screw Boat with 340 s.hp. for a Well Known Philadelphia Yachtsman

THOUGH Diesel power has entirely supplanted steam and gasoline for the larger yachts it has not entirely conquered the domain of yachts of intermediate size and for small yachts it has so far been very little adopted. The reason therefore seems to lie in the explanation that the cost of gasoline is excessive beyond all dispute in the case of big yachts, while in the case of the vessels of lesser power the saving that can be effected by the use of fuel oil is not so enormous and the higher cost of the Diesel engines is, therefore, not so readily accepted. There are still apparently a number of yachtsmen who are not afraid of the hazard of a large gasoline supply, and to them the safety of the Diesel engine does not appeal. In actual practice, of course, the Diesel engine also has the advantages that it operates more smoothly and quietly, is always under better control and is a more durable piece of machinery.



Alcedo, a seaworthy yacht owned by G. W. C. Drexel

An interesting example of the application of Diesel power to a yacht of intermediate size is furnished by the ALCEDO built for G. W. C. Drexel of Philadelphia. Mr. Drexel has owned three or four steam yachts. His old steam yacht ALCEDO was in the Government service during the war and was torpedoed by an enemy submarine. Since he has used his new motoryacht he has become firmly attached to Diesel power. He states it still seems strange not to have the coal bunkering nuisance and to get away from the smoke and heat of the steam yacht. His impression is that the motoryacht handles just as quickly as the steamer in maneuvering, and there are the additional benefits of being free from banked fires and standby watches for the engineers.

ALCEDO, which was built at the Smith & Williams Company's yard at Salisbury, Md., from the designs of T. D. Bowes, naval architect of Philadelphia, measures 108 ft. overall length, 18 ft. 6 in. beam, and draws 8 ft. 3 in. of water. With a total propelling power of 340 hp. she makes a speed of 13 miles per hour. After she was commissioned last summer, Mr. Drexel used her on the Maine coast, where he has a summer home at Isleboro. This winter the yacht will be in southern waters.

In addition to her main deck she has only an awning deck, on which are located the helmsman's stand, wheelhouse and chart room. In the main deck house forward is the large dining room and aft there is a commodious lounging room. Below deck the after part comprises the owner's quarters, which include three bedrooms and two bathrooms. Forward are the crew's quarters, which consist of three staterooms, one for the captain, one for the chef and steward and one for the chief engineer and his assistant, together with an officers' mess and galley, and accommodation for four sailors and berths.

The midship space is occupied by the engineroom with its two Bessemer engines of 170 hp. each, exhausting through Maxim silencers in the stack. These engines drive 50 in. by 50 in. Columbia bronze propellers at 350 r.p.m. The engineroom auxiliaries consist of a 2-cylinder 12 hp. Hill engined generator set of 8 kw. and a single cylinder 6 hp. Hill engined generator set of 4 kw., both generators being of the G. E. type, two Viking electrically driven fuel transfer pumps, two Viking electrically driven bilge and fire pumps, and one Goulds water pressure system for supplying water to all quarters. In addition thereto there is a battery of 58 cells, providing current for lighting and thus avoiding the need for keeping the generator set running at night.

For heating the vessel there is an Arcola boiler, and for the hot water supply to the owner's quarters and galley there is an attachment to the galley range. Fuel oil is carried in four tanks of 2000 gal. capacity located under the floor forward and a similar capacity is provided with four tanks in the after part of the engineroom. The day service tanks have a capacity of 150 gal. This provides about 3000 miles endurance.

So far the fuel consumption for both engines has been about 16 gal. per hour average, and the lubricating oil consumption is at the rate of about 30 gal. of Vacuum D. T. E. heavy oil for each 4000 gal. of fuel oil consumed. The engine oil is passed through two Nugent oil filters fitted with light and bell alarm.

On deck there are two electrically driven units, one being an American Engineering Company's windlass and the other an electric boat hoist made by the same company. Two motor launches are carried, each powered with a 4-cylinder Universal motor.

Submarines Win Trophies

In the awards of engineering trophies in the United States Navy for the engineering performance year 1924-1925 the submarine branch of the service has made a remarkably fine showing.

S-12, winner in the submarine class, outshone the trophy winners in the other classes with a merit about 12 points higher than any other. Her merit was 133.607; the next best was the 121.716 of the CONCORD in the light cruiser class.

Submarine honors did not end here. Of the seven vessels in all classes awarded "red letters" for having obtained a merit equal to at least 98 per cent of the merit of the trophy winner in their respective classes, three were submarines.

Fuel economy is the largest factor in scoring, but the factor of reliability enters and the annual full power trials have an influence.

S-12, trophy winner in the submarine class with a merit of 133.607, had Lieutenant Commander J. D. Jones as commanding officer and Lieutenant G. H. Dana as engineer officer.

In the awards for vessels obtaining a merit of 98 per cent or more of the merit of the trophy winner in their respective classes the R-6, O-3 and S-13 were named.

R-6, merit 131.965, was commanded by Lieutenant (J. G.) R. W. Abbott, who was also engineer officer.

O-3, merit 131.376, was commanded by Lieutenant C. H. Waters, with Lieutenant (J. G.) R. F. Yager as engineer officer.

S-13, merit 131.258, was commanded by Lieutenant F. P. Thomas, with Lieutenant (J. G.) W. M. Hainer as engineer officer.

A national shipping drive is planned by the Propeller Club of New York.

Sperry gyro compasses have been ordered by the Shipping Board for the 14 vessels that are being converted from steam to Diesel power. The total cost of this equipment is about $53,000.

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Trend of Diesel-Electric Propulsion

Orders Are in Hand for 20 Vessels of Various Types with This System of Propulsion

J. W. VANDYKE, formerly the S.S. ALLENTOWN, a 7500-ton tanker owned and operated by the Atlantic Refining Company, was converted from geared turbine drive to Diesel-electric drive and placed in service about six months ago. The propelling machinery consists of a double armature, 2300 hp., 100 r.p.m., 750 volt motor supplied by three 600 kw. Diesel-driven generators.

All other equipment on the vessel, including cargo pumps, is electrically driven. The pumps are controlled directly from the deck by means of remote-control starters and speed regulators. The rate of discharge of the pumps is shown by a speed indicator located at the deck control station and calibrated in barrels per hour. This is a unique feature and was first applied on this ship. The performance of the electrical machinery on the J. W. VANDYKE compares very favorably with the best direct drive Diesel practice, consuming 0.468 lb. of fuel per s.hp.-hr. for all purposes while at sea. It is planned to place this ship in transatlantic service.

A number of ferryboats have been provided with electric propulsion through fore and aft propellers, but for the first time, Diesel-electric drive was applied last year to the operation of a sidewheel ferryboat, the F. M. COOTS, used for passenger and freight service between Jeffersonville, Ind., and Louisville, Ky.

This equipment consists of two Diesel engines, each driving a 125 kw. generator supplying current to two 175 hp. motors gear connected to the side paddle wheels.

For the three new Golden Gate ferries for San Francisco, Diesel electric propulsion has been adopted on account of the very satisfactory service obtained from the two Diesel-electric ferryboats the company has had in service for nearly three years. The new boats will be of large size.

Marking an important development on the Great Lakes, the Isthmian Line, controlled by the United States Steel Corporation, has ordered a Diesel-electric cargo ship for service on the lakes and canals. The propulsion plant consists of a 750 hp., 135 r.p.m., 690 volt motor driving a single propeller and supplied with power by three 205 kw. Diesel-driven generators having direct connected exciters. This vessel is to go into service simultaneously with a direct Diesel drive sistership of 1000 s.hp. Due to the better and more flexible control of thte former as compared to the latter it is expected to give comparable service.

The ease, accuracy and flexibility of bridge control afforded by the Diesel-electric system of propulsion is regarded of prime importance for maneuvering a ship through canals and locks where the slightest slip might endanger the safety of the ship and property.

The well-known U. S. coast guard cutter BEAR will be superseded by a new cutter designed for Alaskan service and provided with Diesel-electric propelling equipment. This will consist of two 750 hp. Diesel engines each provided with a 410 kw. generator. These sets will supply energy up to 1000 s.hp. to a 120 r.p.m. double armature motor; and field control of the generators will be utilized for operating the propeller over a wide speed range. In addition to the main generator sets, there will be two independent Diesel-electric sets of 60 kw. each which can be utilized for supplying excitation and auxiliary power in place of the direct-connected exciters of the main engine sets.

Following the highly successful experience of the Pennsylvania Railroad Company with its Diesel-electric tug No. 16, this railroad has decided to equip five new tugboats with Diesel-electric drive. Three of them will be substantially duplicates of the P.R.R. No. 16, having 575 hp., 125 r.p.m., 550 volt double armature motors, driving a single screw and supplied with power by two 235 kw. Diesel-driven generators. They are also planning two drill tug boats, each being provided with a 250 hp. double armature motor driving a double-ended propeller arranged by means of a through shaft and supplied with power from two 105 kw. Diesel-driven generators.

In addition to these five tugboats just mentioned two 430 hp. Diesel-electric tugboats for the Wilmington Transportation Company in Los Angeles will be very similar, from point of equipment, to those of the P.R.R. Co., except as regards the arrangement of the control. These will be the first Diesel-electric tugboats on the Pacific Coast.

A marked improvement in the development of Diesel-electric towboat drive lies in the dead front feature of the switch and control boards. All main auxiliary switches as well as feeder switches will be mounted on the rear of the boards and operated from the front, there being no live connections at the front of the board. This dead front feature is used by the company on practically all of the Diesel-electric propulsion installations for the main equipment only and is now being extended to the auxiliaries and feeders in the design of their new tugboat equipments.

Two Diesel - electric towboats were ordered by the New York Central R.R. at the end of 1925, full details of which appear on another page.

Diesel-electric propelling equipment is under construction for three stern-wheel towboats for the Engineers Corps of the Army. Two of these are 70 ft. in length and will be assigned to the Cincinnati district; the third is 100 ft. in length and will be utilized in the St. Louis district.

The equipment for the smaller boats consists of an 85 kw. generator set supplying power to a 100 hp. motor which drives the stern paddle wheel through chains. The exciter is direct connected to the main engine and, in addition to supplying excitation, provides current for the operation of electric capstans, pumps, refrigerators, etc.

On the 100 ft. boat two engine-driven generator sets are provided, each having an output of 90 kw. and supplying power to a 225 hp. motor which, in this case, drives the stern paddle wheel through gears and pitmans. Direct-connected exciters are provided for both generating sets and supply current for both excitation and the operation of auxiliaries.

Marked progress has been made in the electrical equipment of dredges. Apparatus has been constructed during the last 12 months for a large pipeline dredge, a seagoing dredge of the hopper type, and for the largest electrically operated dipper dredge ever built.

On the 20 in. pipeline dredge, which will be used for maintaining a channel from Philadelphia to the sea, all of the motions are operated electrically with the exception of the main dredge pump which is engine driven. The equipment comprises two 585 kw. generators which supply current to a 200 hp. cutter motor, 125 hp. hoisting and hauling motors, and various auxiliaries. In addition to supplying direct current for its self-contained equipment, it furnishes 2300 volt, 60-cycle alternating current from a motor-generator set to a booster pump motor located out on the pipeline.

The equipment of the seagoing hopper dredge WILLETT'S POINT, includes 400 and 200 hp. motors for the dredge pumps as well as many smaller units for steering gear, refrigeration, deck machinery, etc. An unusual feature of the equipment consists of two automatic drag operating winches which maintain a constant tension on the dredge hoisting lines and insure a constant depth for the drag, thereby greatly increasing the efficiency of the dredging operation.

The equipment for the record size dipper dredge, which will be utilized by the Great Lakes Dredge and Dock Company, is similar in many respects to that installed on large electric shovels, except that, in view of the enormous bail pulls, the equipment will have greater capacity than is required for shovel work. Some idea of the power required for the operation of this dredge can be obtained from the fact that the dipper, which is of 10 cu. yd. capacity, has a bail pull of 350,000 lb., and that motors of approximately 600 hp. are required for the main hoist motion. The electrical equipment comprises Diesel-electric generators of 900 kw. capacity and the aggregate rating of the motors is in excess of 1400 hp.

Recognizing the inherent merits of Diesel-electric propulsion for fireboat service, the city of Houston has placed an order for such a boat for the protection of the water bordered portion of the city. Two 360 hp., 265 r.p.m., 500 volt motors driving twin propellers are utilized. They are supplied with power by two 350 kw. Diesel-driven generators. The pumping plant consists of a 410 hp., 1750 r.p.m. motor-driven fire pump.

ALOHA, owned by Arthur Curtis James, is now being converted to Diesel-electric drive. She is the largest yacht to be fitted with this type of propulsion machinery consisting of a double armature, 640 hp., 180 r.p.m., 500 volt motor driving a single propeller and supplied with power by three 175 kw. Diesel engine-driven generators.

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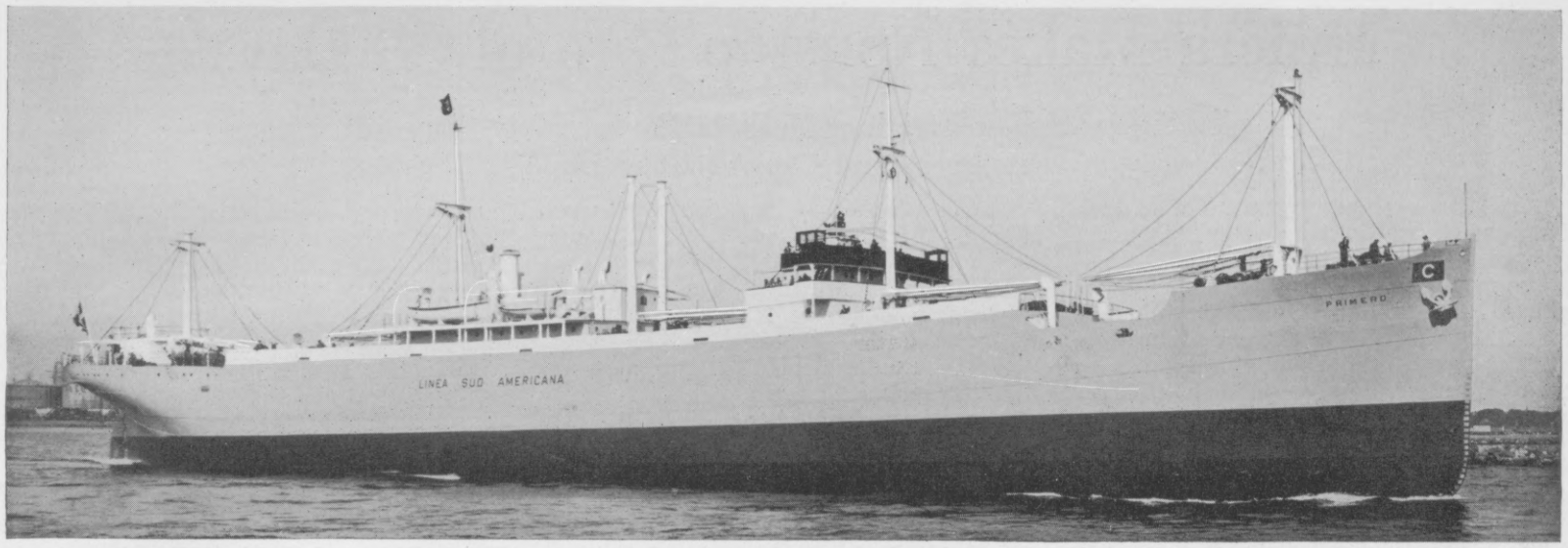


Primero, one of the three 7800 tons d.w.c. motorvessels of the Garcia & Diaz service between New York and B. A.

New Vessels of Linea Sud Americana

Line of Motorships Operated by Garcia & Diaz Between New York and River Plate

PRIMERO, first of three motorvessels for the Linea Sud Americana was completed in August and set out on her maiden passage to New York to load for South American ports on the service which Garcia & Diaz are operating between New York and the River Plate. She is a vessel of 4414 tons gross, with a deadweight capacity of 7800 tons on a loaded draft of 23 ft. 11 in. Between perpendiculars she measures 367 ft. Her molded breadth is 53 ft. 6 in. and the molded depth to the upper deck is 27 ft. 6 in. Of the single deck type with poop, bridge and forecastle, she is divided by six watertight bulkheads and has four cargo holds, two forward of the engineroom and two aft. A double bottom extends the entire length of the ship with a capacity of 1060 tons of fuel and makes up with the fore and aft peaks a water ballast capacity of 1435 tons. Her propelling machinery consists of two 6-cylinder B. & W. engines of the trunk piston type giving about 1725 s.hp. and driving the ship at 10½ knots. Three generator sets are installed, two of 33 kw. each and one of 66 kw., providing current for lighting and for the auxiliary machinery, including the deck winches, windlass and the steering gear—the latter being of the Vickers electro-hydraulic type controlled by a telemotor on the bridge.

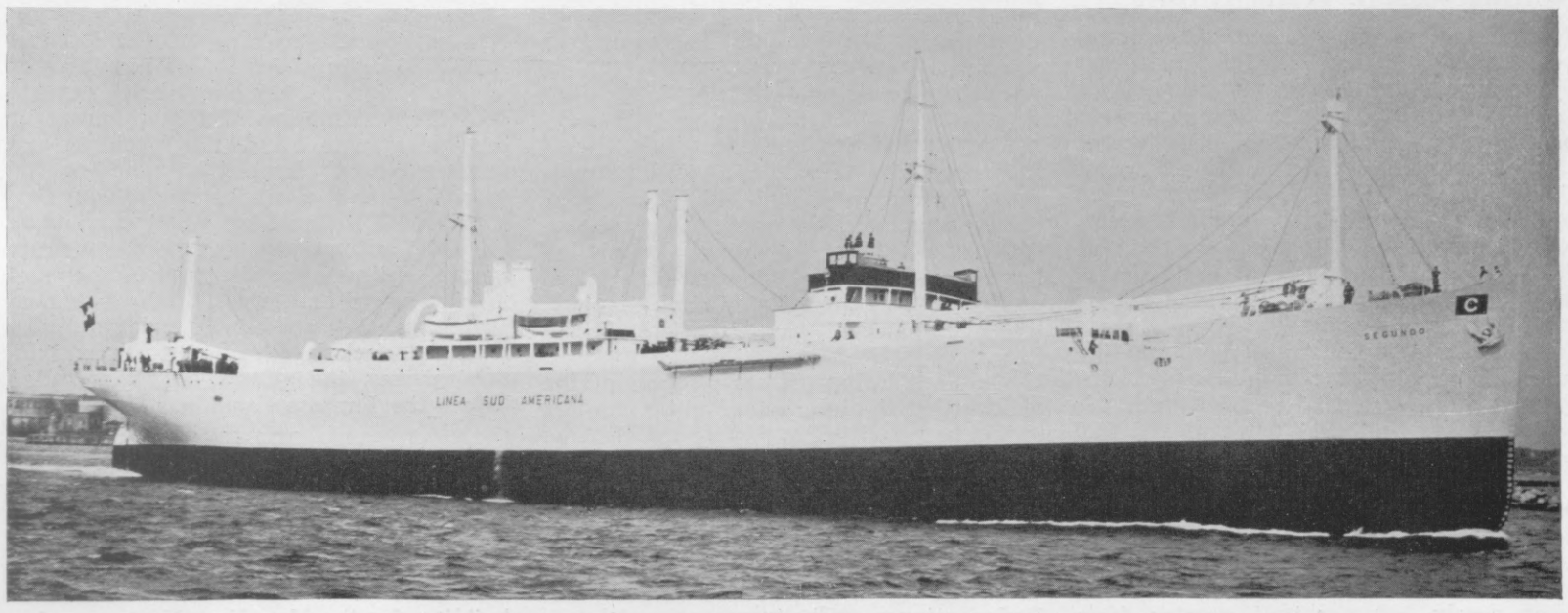
On her maiden transatlantic passage, which was from Ornskjoldvik, Sweden, via Copenhagen to Boston, Mass., with a full cargo of wood pulp, the distance was covered in 17 days at a mean speed of 10.3 knots and she arrived at Boston on Aug. 17.

Very heavy weather was encountered, with westerly winds up to strength 4 on the Norwegian scale (equal to Beaufort scale 8). The highest mean speed for 24 hours was 11 knots on August 16 and 17 and the lowest speed was 9 knots on August 8 and 9, with a wind of scale 4 (Norwegian). The main engines worked at a mean speed of 148 r.p.m.

For the entire passage the mean fuel oil consumption per 24 hours was 7.4 tons, including the consumption of the auxiliary machinery. After her arrival at Boston the consumption of lubricating oil was very carefully checked, the oil remaining in the bottom tank being measured. The total lubricating oil consumption for the whole voyage, including waste and evaporation from the sump tanks, worked out at 0.53 grams per i.hp.-hr.

Her first voyage from New York to Montevideo was made in 25 days at a mean speed of 10.3 knots, with a fuel oil consumption of 7.4 tons per day and the total lubricating oil consumption was reduced to the exceedingly low figure of 0.43 grams per i.hp. hour. The highest mean speed was 10.9 knots on September 25 and 26 and the lowest was 9 knots on September 28 with a wind scale 4.

SEGUNDO, the second vessel for the Linea Sud Americana and a sister ship, is also in service. A third vessel, TERTIO, remains to be completed. All three are the product of Burmeister & Wain in Copenhagen. The line was initiated early this year with the chartered m.s. BORGESTAD.



Segundo, the second motorship of the new line, is also in service now between New York and the River Plate

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Mulcra Makes Nonstop Run of 58 Days

Small Australian Freighter Built in Europe Makes Record Passage Round Cape of Good Hope

AFTER a continuous passage of 58 days, during which her engine was never stopped, the Adelaide S. S. Co.'s single screw motorship MULCRA, 1450 tons d.w.c., arrived at Adelaide, South Australia, on Nov. 29. She had sailed from Blyth, England, on Oct. 1 after loading coal and went out round the Cape of Good Hope. This is probably the longest continuous passage ever made by a power driven vessel of this size.

MULCRA, which was built by the Svendborg Skibsvaerft, Denmark, and engined and completed by Burmeister & Wain, has the following leading characteristics:

Lenth overall	225 ft. 0 in.
Length b.p.	215 ft. 0 in.
Breadth molded	34 ft. 0 in.
Depth molded	15 ft. 6 in.
Deadweight	1,450 tons
Gross register	1,168 tons

She has two cargo holds, each with two hatches, 16 ft. 0 in. wide and 20 ft. long, served by two tubular steel derricks to each hatch and 3 ton winches. The capacity of the holds is 79,400 cu. ft. grain and 74,200 cu. ft. bales.

In the cellular double bottom there are five compartments built for fuel oil or water ballast. The oil fuel capacity is 227 tons. With fore and after peaks the water ballast capacity is 341 tons.

Around the engine casing amidships accommodation is arranged for the officers and engineers, while the captain's cabin is situated on the bridge house deck with the chartroom under the navigating bridge. The crew is housed in the poop, with separate messrooms for sailors and motormen.

For propulsion there is a 6-cylinder B. & W. long stroke trunk piston engine giving about 750 s.hp. at 125 r.p.m. All the pumps for the operation of the main engine and the bilge pump and sanitary pump are driven by the main engine. The daily fuel consumption is about 3 tons, and the fuel tank capacity is thus suited to an endurance of 20,000 miles.

There are two auxiliary generator sets, one of 33 kw. and the other of 66 kw. supplying current at 220 volts for power, with a motor generator set to give 110 volts for lighting. The compressors of both auxiliary engines have l.p. clearance increase devices to enable them to be used to supply maneuvering air when needed. Both sets have to be operated when the vessel is entering or leaving port, or when cargo is being loaded or discharged. At other times the small auxiliary is ample, and it too can be shut down at sea if desired, the electric hydraulic steering then being replaced by hand steering.

Australia's first Diesel engined coastwise vessel, the Mulcra, of Ad elaide, which went out from Europe without bunkering on the way

Intercoastal Traffic Grows

An index of the importance of the intercoastal trade of the United States to the Panama Canal is shown in the Canal statistics. In the year 1921 the total cargo tons of the U. S. intercoastal trade moved through the Canal from the Atlantic to the Pacific represented 18.1 per cent of the total cargo tons transiting in that direction.

It increased to 30.2 per cent in the year 1922, rose to 38.2 per cent in 1923, fell back to 31.4 per cent in 1924 and during the first nine months of 1925 climbed again to 33.4 per cent. The corresponding figures for the transits from the Pacific to the Atlantic have been 16.4 per cent, 28.7 per cent, 58.0 per cent, 48.7 per cent and 44.0 per cent.

The growth of the intercoastal trade has been very considerable. In the first nine months of 1925 it exceeded by more than 100 per cent the volume it had attained in 1921 from Atlantic to Pacific, and has become nearly 500 per cent greater from Pacific to Atlantic. The total intercoastal cargo tons which have passed through the Canal during the first nine months of 1925 amount to 7,000,000 tons.

Protesting Intercoastal Regulation

A strong letter of protest against the proposed legislation that would place intercoastal water carriers under the regulation of the Interstate Commerce Commission has been sent to the Maritime Association of the Port of New York by C. J. Beck, Vice President of the United American Line.

Mr. Beck stated—"I am strongly of the opinion that the intercoastal water carriers should be permitted to develop the Panama Canal route without the handicap of regulation of any kind whatsoever other than that already contained in the shipping act."

Laying the responsibility for the efforts to introduce such legislation on the shoulders of the trans-continental railroads, Mr. Beck continues—"The transcontinental railroads do not seem to be able to reconcile themselves to the economic changes wrought by the opening of the Panama Canal. Dwelling in the fond memories of an opulent past, they watch with envious eyes the perfectly natural development of the water route between our eastern and western coasts. Instead of accepting the inevitable and synchronizing their own efforts with those of the water carriers to the end that commerce may flow through its natural channels for the good of the community served and eventually to their own advantage, they are blindly endeavoring to turn the clock back and restore, by artificial means, the situation that prevailed before the Panama Canal was opened."

Two motorliners of 30,000 tons gross each are being planned by the Cosulich Line for the New York-Mediterranean passenger service, according to reports from Italy. These vessels will be of about the same size as the AUGUSTA which the N.G.I. is building for the New York-Naples service.

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New York Central R.R. Orders Two Tugs

Will Be of Diesel-Electric Type and Most Powerful Towboats in New York Harbor

FOLLOWING closely upon its decision to convert its two tugs Nos. 21 and 22 from steam power to Diesel propulsion, the announcement of the placing of contracts for two Diesel-electric towboats indicates that the New York Central Railroad is launching itself wholeheartedly into the modernization of its towing fleet. These two new tugs are needed to cope with growing traffic in the harbor and will be of the largest type, designed for handling carfloats and for operating 24 hours a day and seven days a week. Of this size of tug the New York Central possesses 14 boats, all steamers, the largest of which has about 1100 i.hp.

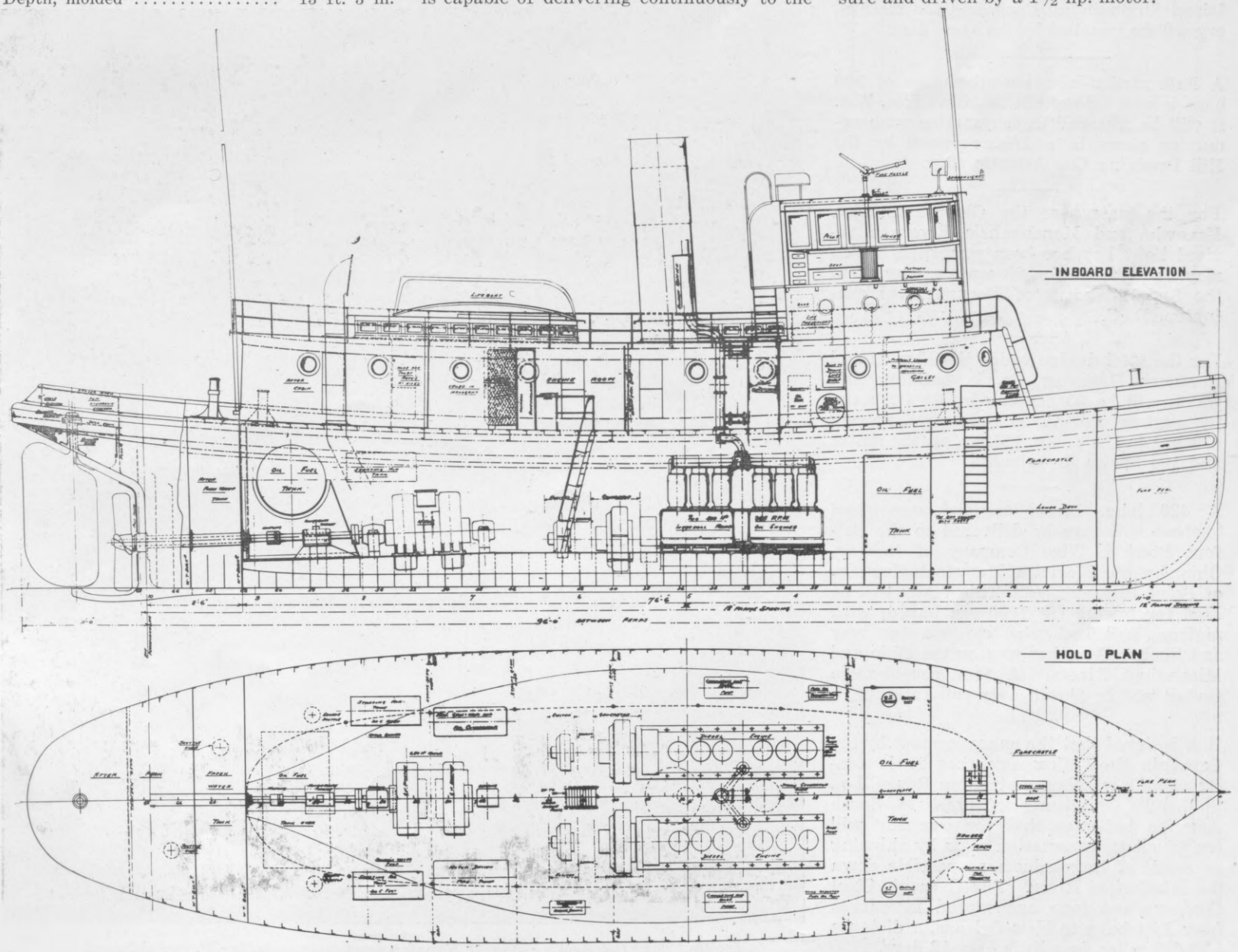
The motortugs will have about the same power and are expected, of course, to make a much better showing. The new vessels have been designed by J. W. Millard & Bro., naval architects, New York, and their principal dimensions are as follows:

Length on deck	108 ft. 0 in.
Length b.p.	96 ft. 0 in.
Breadth, molded	26 ft. 0 in.
Depth, molded	13 ft. 3 in.

The design conforms in general to that of the steam tugs owned by the same company. Most of the space below deck is given over to the machinery, and there is a large deckhouse extending about two-thirds the length of the vessel, above which is built the pilot house at a sufficient height to give clear vision over the top of the car floats. There are four watertight bulkheads, one about 12 ft. 0 in. from the stem forming a collision bulkhead, one forward of the engine room and two aft of the engine room, forming the after peak tank. The second forward bulkhead is part of the fuel oil bunker.

In the large open space given over to the machinery will be installed all the engines, electrical equipment and pumps. In one boat the main engines consist of two six-cylinder Ingersoll-Rand sets developing 450 b.hp. at 265 r.p.m., direct connected to 270 kw. 240 volt d.c. generators of the General Electric type and with 50 kw. 120 volt exciters attached. These sets will supply power for the main propelling motor which is capable of delivering continuously to the tail shaft 650 hp. at any speed between 115 r.p.m. and 145 r.p.m. In the other boat the main engines will be two six-cylinder McIntosh & Seymour engines developing 400 b.hp. at 300 r.p.m., direct connected to the same size generators and exciters as detailed above, but of course, with a smaller power delivered on the electric propelling motor because of the lesser power of the main engines to be installed.

Power will be taken from the exciters for operation of all the pumps and for the electric hydraulic steering engine. The biggest pump is the fire and wrecking pump, capable of delivering 1000 gal. per min. at 150 lb. pressure. This pump can be connected with a 4 in. monitor nozzle, with 1⅜ in. brass tip, on top of the pilot house. There are two pumps for circulating water and bilge service, both of the rotary type with a capacity of 175 gal. per min. against 30 lb. pressure, and driven by a 5 hp. motor. The fuel oil transfer pump is of the same type, but with a capacity of only 30 gal. per min. against the same pressure and driven by a 1½ hp. motor.



Inboard profile and hold plan of the Diesel electric towboats which the New York Central Railroad has just ordered

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To furnish starting air and to provide lighting when the main engines are not operating, there will be a 6 hp. single cylinder Hill engine, using the same fuel as the main engines, direct connected to a 4 kw. 125 volt d.c. generator, the shaft of which is extended to drive a single-acting air compressor through a friction clutch. Air is furnished at 200 lb. pressure.

In the McIntosh & Seymour engined tug the starting air is replenished by the engine compressors, but in the other boat there will be installed a separate starting compressor set, due to the fact that the Ingersoll-Rand engines, being of the airless injection type, have no direct connected compressors. The Ingersoll-Rand auxiliary will consist of a two-cylinder 2-stage compressor with cylinders 6¼ in. and 2¾ in. x 5 in. direct connected to a G. E. motor and delivering air at 200-250 lb. pressure.

Complete control of the vessel, including the regulation of the main propelling motor and of reversing is installed in the pilot house. This is regarded as one of the great advantages of Diesel-electric propulsion for tugs operating in New York waters. When the tug is handling two 17-car floats, each 360 ft. long, the ability ot the captain to obtain almost instantaneous reverse, such as the Diesel-electric system provides, is really a point of considerable superiority over steam.

The new hulls will be built by the Staten Island Shipbuilding Corp. and the machinery will be installed by the same firm.

A Falk airless-injection oil engine of 900 b.hp. is now being built at Milwaukee, Wis. It will be installed in conjunction with reduction gears in a dredge owned by the Hill Dredging Co., Atlantic City.

For the waters of the Ohio, Tennessee, Kanawha and Monongahela Rivers a revised light list has been published, which may be obtained for 20 cents a copy from the Superintendent of Documents, Washington, D. C.

For the steel dredge which the Florida and Southern Dredging Co. is building and which will be 80 ft. long by 30 ft. beam, the engines will all be Bessemers, namely 450 hp. on the pump, 125 hp. on the cutter and 100 hp. on the winches.

A 420 b.hp. Diesel engined sternwheel towboat will soon be delivered to the Belfont Steel & Wire Company of Belfont, Ohio, by the Marietta Manufacturing Co. of Point Pleasant, Va. This vessel will be used for towing six 1000 ton barges with pigiron, nail and wire cargoes one way and lumber the other way on the Ohio and Mississippi Rivers. A very considerable saving will be shown over rail rates.

It is believed that the announcement by the Carnegie Steel Company that it is constructing a warehouse at Baton Rouge, La., to handle shipments of steel to South America indicates that the company will try to cut transportation costs by shipping as much of its products as possible down the Mississippi River. The Carnegie Steel Company not long ago moved 11 barges from Pittsburg to New Orleans, a distance of 2,000 miles, in a little over 12 days.

Arctic Schooner Nanuk

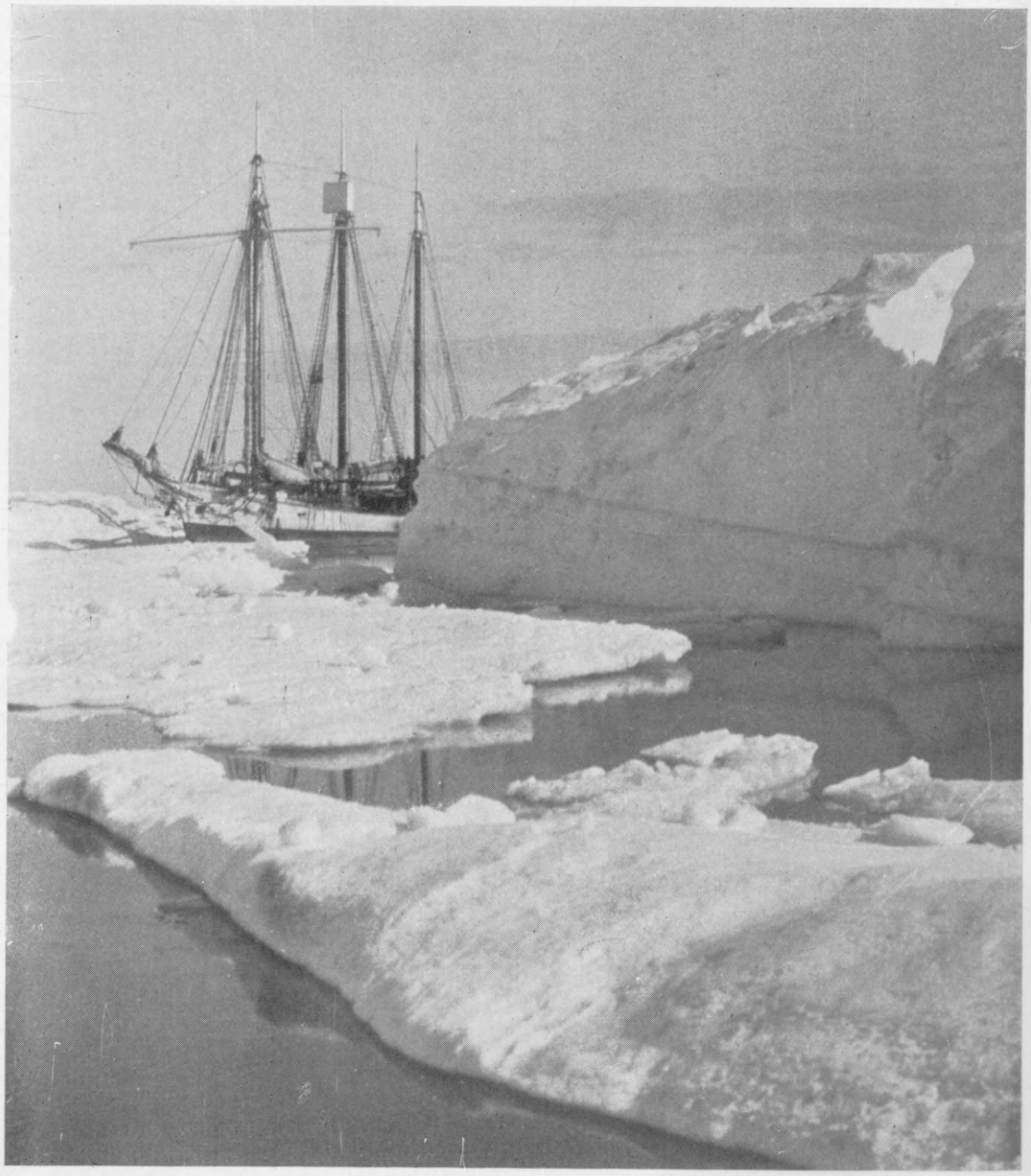
AFTER six months in the Arctic Ocean the power schooner NANUK recently arrived in San Francisco. She is owned by the Northern Whaling & Trading Company, by whom she was sent north on a trading and whaling expedition. She went first for furs on the Arctic coast of Canada and after she had finished her trading business pushed east of the McKenzie River in search of whales.

Unfortunately, a couple of westerly gales slammed the icepack in on the coast, and when the vessel arrived back at Herschel Island the captain found the way blocked. He waited a few days hoping for a favorable wind to open up the ice, but with winter almost at hand, he soon gave up waiting and put up a hard fight to get out. It took him five days of 20 hours each to blast and buck his way a few miles around Herschel Island. In three of the five days he made only two miles. The ice was the heaviest, he states, he had ever seen. A lot of it was aground in 70 ft. of water, but by tackling the smaller ice up against the bank and often bucking it with the keel of the boat touching bottom, he succeeded in getting through.

The engineer states that during that period he received so many bells from full speed ahead to full speed astern that he thinks he must have had one every minute. The bells came so fast and so steadily that he had to have a man stand by the bell and call the orders to him. During those five days the engine, which is an Atlas-Imperial, answered every signal.

On the final run from Juneau, Alaska, to San Francisco, 2,100 miles in 14 days, the engine used 3,600 gallons of fuel oil and 90 gallons of lubricating oil. Owing to the fact that so much fuel had been burned without making any headway when bucking the ice around Herschel Island, the ship ran short of Diesel oil. The wind did not favor her and in order to get the vessel into port without delay the engineer helped out his dwindling fuel supply with the following odds and ends: Used lubricating oil, aviation gasoline, coal oil, distillate, rotten whale oil and the cook's savings of pork grease. The captain states he did not notice any difference in the operation of the engine while she was running on that mixture.

Schneider & Cie of Paris has acquired a license to build Burmeister & Wain engines, but for submarines will continue to build to its own design as in the past.



Ice that gave the Arctic schooner Nanuk a hard time rounding Herschel Island

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Plans for First U. S. S. B. Motorships

Outline of Alterations to Two Steamers of Seminole Class and Installation of Diesel Engines

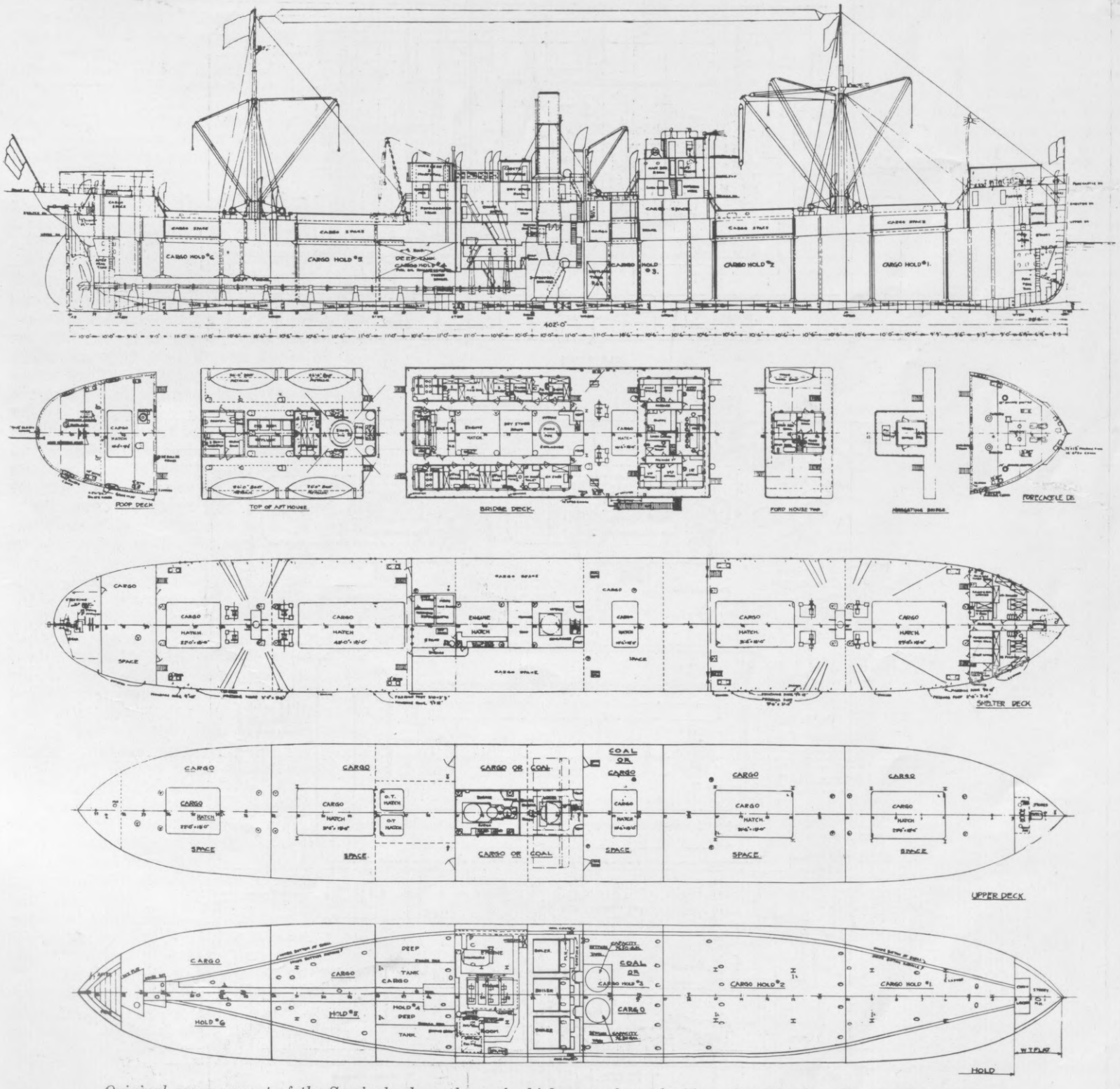
BIDS for the work of installing the new machinery in the first two of the 14 vessels which the Shipping Board is converting to Diesel power were opened last month. Choice was given to bidders of any two of the three ships, SEMINOLE, UNICOI and TAMPA, the first lying at Hoboken, N. J., and the two latter in the James River, Va. The bids include the cost of taking out the steam machinery and of making certain repairs, renewals and alterations in the ships. Work is to be completed on the first vessel in 120 days and on the second vessel in 135 days, reckoned in both cases after delivery of the ship to the contractor.

The following bids were received:

NAME OF BIDDER	ONE SHIP	TWO SHIPS
Bethlehem S. B. Corp...	$448,545	.....
Morse D. D. & R. Co....	388,900	.....
Newport News S. B. & D. D. Co.	.....	$707,000
Sun S. B. & D. D. Co....	.....	985,000
Todd Shipyards Corp.....	.....	923,930

Following are the general data and characteristics of the vessels as they will be after being converted to Diesel power:

Length overall	416 ft. 0 in.
Length b.p.	402 ft. 0 in.
Beam molded	54 ft. 0 in.
Depth molded to shelter deck	33 ft. 9 in.
Gross register (estimated)	5,950 tons
Net register (estimated)	3,665 tons
Construction	Longitudinally framed
Spacing of transverses	10 ft. and 11 ft. 0 in.
Normal mean load draft	26 ft. 10¾ in.
Deadweight capacity, about	9,400 tons
Power of main oil engine	2,900 b.hp.
Normal speed, service condition (about)	11½ knots



Original arrangement of the Seminole class, three of which are to have double-acting Diesel engines in place of steam

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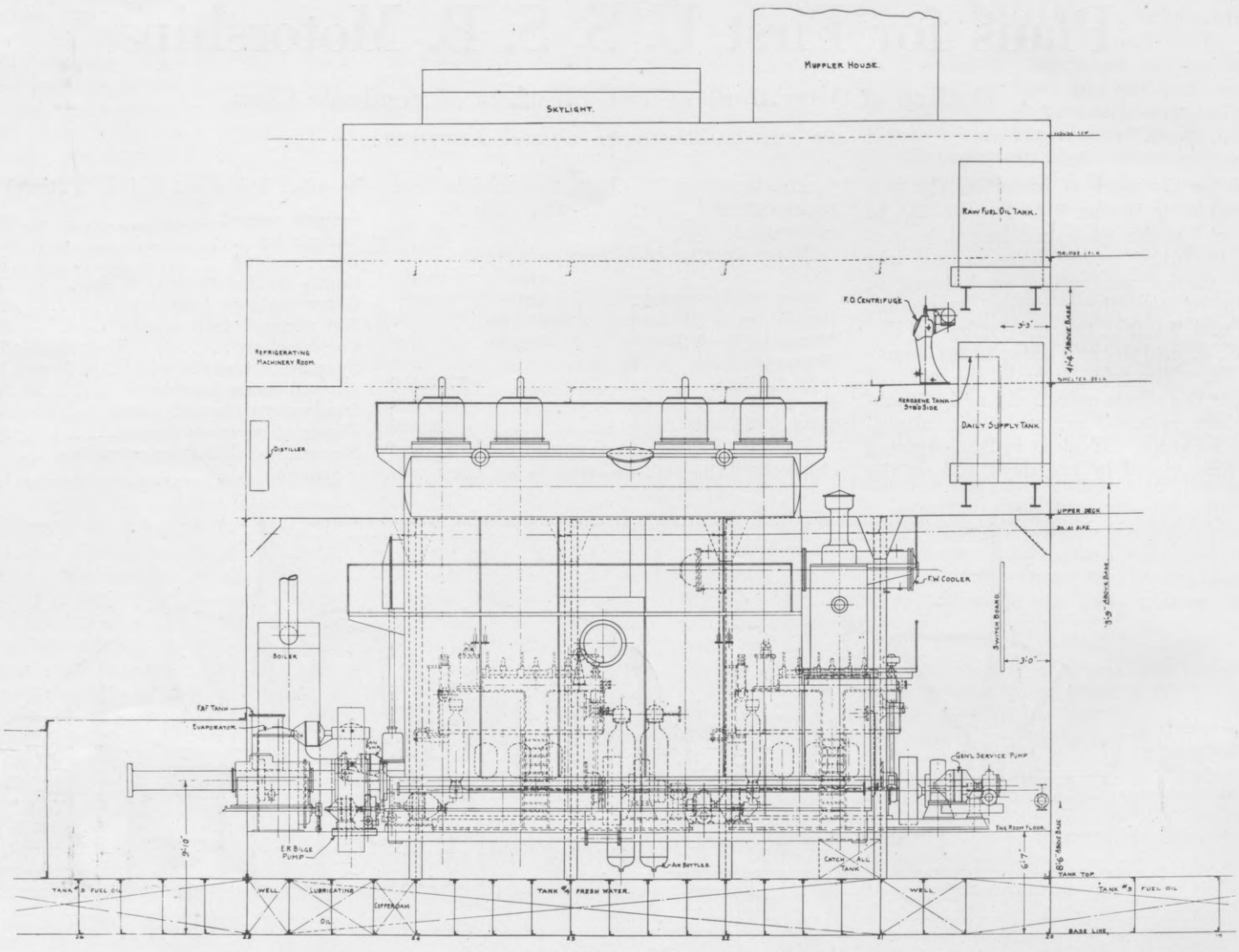

New engine room arrangement of the Seminole class ships which are to have double-acting Diesel engines installed

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These first two vessels are to have the Worthington type of double-acting 2-cycle engine with four cylinders of 28 in. diameter and 40 in. stroke, to develop the guaranteed 2900 s.hp. at 95 r.p.m. The engine weighs about 600,000 lb. with attached compressor and scavenge manifold, ladders, gratings and platforms attached to engine, flywheel with turning gear, and all gauges, thermometers, etc. It measures 31 ft. 7 in. base length and 10 ft. 10 in. base width, leaving plenty of space around it in the engineroom.

There are three auxiliary sets to be installed, each consisting of a three-cylinder air-injection Worthington engine of 115 hp. direct connected to a 75 kw. generator on a common base. Each set weighs 55,200 lb. complete. Two will be on the port side and one on the starboard side.

The pump equipment will comprise the following centrifugal pumps, all supplied by the Nash Engineering Co.:

2 saltwater cooling pumps, of 750 g.p.m. capacity at 35 lb. pressure, driven by a 30 hp. motor.
1 fresh water cooling pump, of 500 g.p.m. capacity at 55 lb. pressure, driven by a 30 hp. motor.
1 fire and bilge pump, of 200 g.p.m. capacity at 100 lb. pressure, driven by a 20 hp. motor.
1 engine room bilge pump, of 300 g.p.m. capacity at 20 lb. pressure, driven by a 7½ hp. motor.
1 sanitary pump, of 70 g.p.m. capacity at 55 lb. pressure, driven by a 7½ hp. motor.
1 fresh water pump, of 70 g.p.m. capacity at 55 ib. pressure, driven by a 7½ hp. motor.

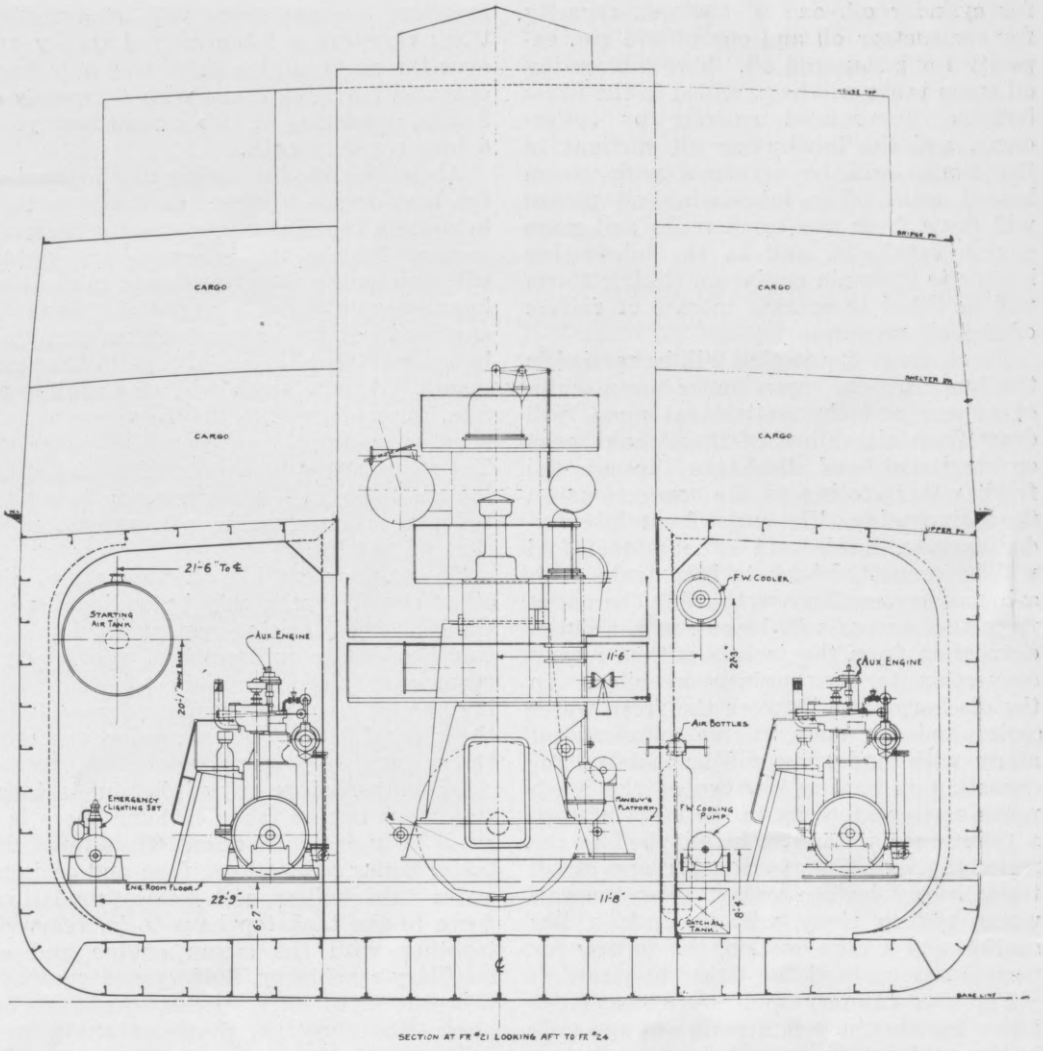
In addition thereto three Kinney rotary pumps are to be installed, two of 150 g.p.m. capacity and driven by a 7½ hp. motor for the lubricating oil service and one of 250 g.p.m. capacity and driven by a 20 hp. motor for the fuel oil transfer. A rotary handpump will be provided for the lubricating oil system and another for the fuel oil system to permit the circuits to be filled by hand. Three DeLaval centrifuges are provided, two of 300 g.p.m. capacity each for the fuel oil, close to the daily supply tanks, and the third for lubricating oil installed on the engineroom floor. Over the cooling pumps on the port side of the engine there will be a large cooler for the fresh water system with a capacity of 800 g.p.m.

Both the starting air tanks, which are of 550 cu. ft. capacity each, will be slung under the upper deck in the starboard wing. Under the after tank will be installed the emergency combined compressor and generating set, which will be driven by a 22 b.hp. Hill engine.

For heating the ship and supplying steam to the heating coils in the fuel tanks an oil fired donkey boiler of 210 sq. ft. capacity is to be provided.

Four fuel oil tanks will be located in the engineroom. Two of these will be the daily supply tanks of about 5 tons capacity each. Above them will be a tank of eight tons capacity from which the oil centrifuges will draw their supply by gravity, these purifiers being placed on a flat adjacent to the tanks, so that the clean oil from them can in turn flow by gravity to the daily supply tanks. Any overflow will be led to the catch-all tank installed below the engineroom floor to receive all leakage from fuel oil pumps of main and auxiliary engines, of strainers, overflows, drain passes, etc.

For the lubricating oil storage three tanks will be used, one of 2200 gal. capacity



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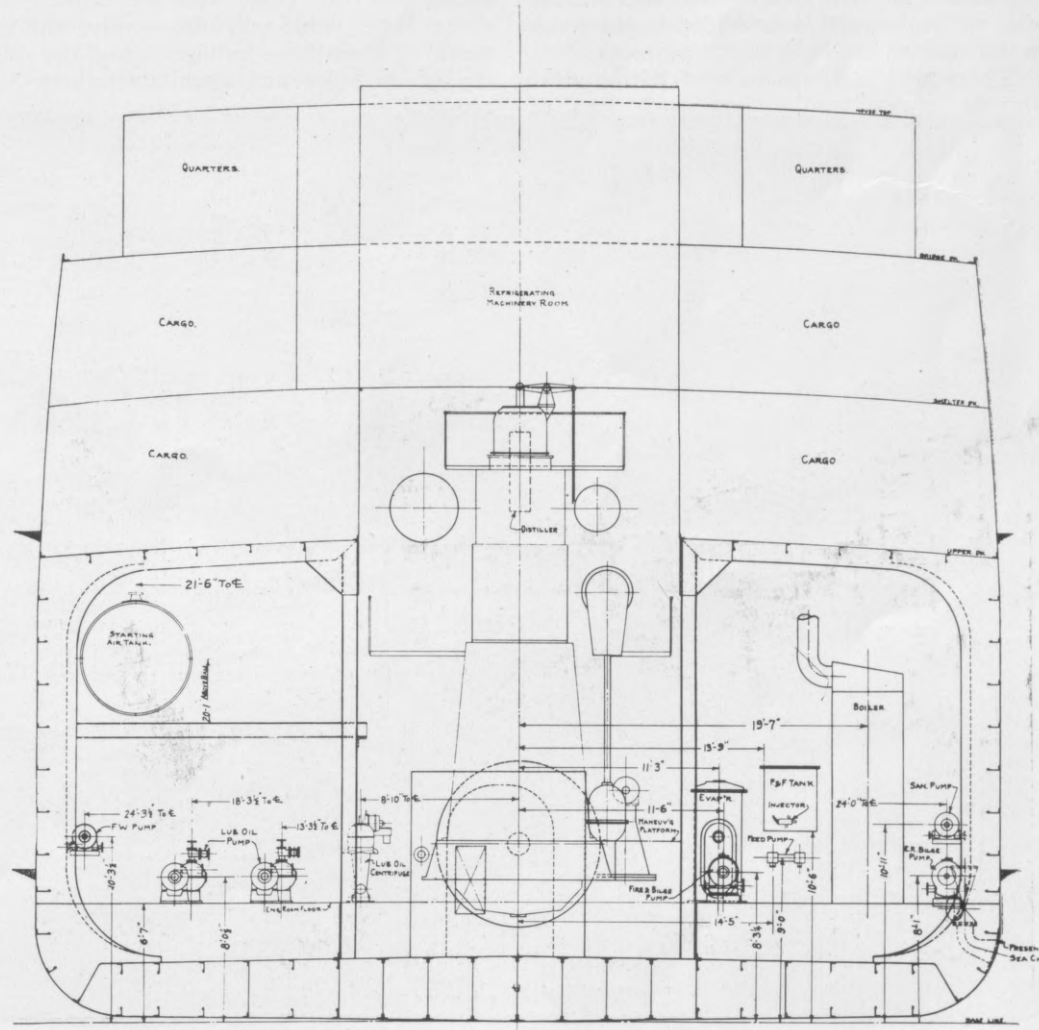

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for cylinder oil, one of 500 gal. capacity for compressor oil and one of 375 gal. capacity for piston rod oil. Two lubricating oil sump tanks will be provided in the inner bottoms, surrounded entirely by cofferdams, and the lubricating oil suctions in the sumps will be arranged with steam heated coils. The lubricating oil pumps will draw from the sump tanks and main engine crankpits, and in the lubricating header to the main engine an electric alarm will be fitted to operate in case of failure of the oil pressure.

Fresh water for cooling will be carried in the inner bottom tanks under the machinery space and the centrifugal pump will draw from either one of these tanks, port or starboard, and discharge through the fresh water cooling to the connections on the main engine. The outlet from the cylinder jackets, heads and exhaust manifold will be connected back to both tanks with a bypass connection overboard. The outlet from the pistons will be run to the outlet connection from the jackets with a bypass connection to the engineroom bilge. In the discharge line between the fresh water cooler and the main engine an electrical alarm with loud gong will be installed for operation in case of failure of the fresh water cooling system. In the event of such a failure sea water can be supplied to the main engine. The auxiliaries are at all times cooled by sea water. For the salt water system there will be both a low suction and a high suction, the former for normal sea use and the latter in rivers.

For the culinary and washroom fresh water system there is a main storage tank in the engineroom connected with an automatic electric water heater made by the Automatic Electric Heater Co. and a similar electric heater will be provided in the fresh water system in the crew's washroom.

There will be three sets of lifting gear in the engineroom. Over each line of auxiliary engines there will be a trolley-track carrying a 2-ton geared trolley and over the main engine there will be a hand operated traveling crane with a capacity of 8 tons, consisting of two geared trolleys of 4 tons capacity each.

Above the engine casing at the level of the boat deck a muffler house will be built to contain the Maxim silencer for the main engine. Each of the three auxiliary engines will also have a Maxim silencer in the line, but these mufflers will be placed close to the engines, and the exhaust from them will be taken through a 10-in. pipe to the stack casing. On the stack will be installed an 8-in. air whistle with visible vapor attachment as made by the Sperry Gyroscope Co. The whistle will be connected to the starting air tanks in the engineroom through a reducing valve providing a whistle pressure of 100 lbs.

The engineroom, like all cargo spaces and other closed spaces, will be equipped with the Rich fire detecting system and Lux carbon dioxide fire extinguisher. The engineroom layout is to be capable of extinguishing fires of great magnitude and provide for the general flooding of the engineroom with the extinguishing gas.

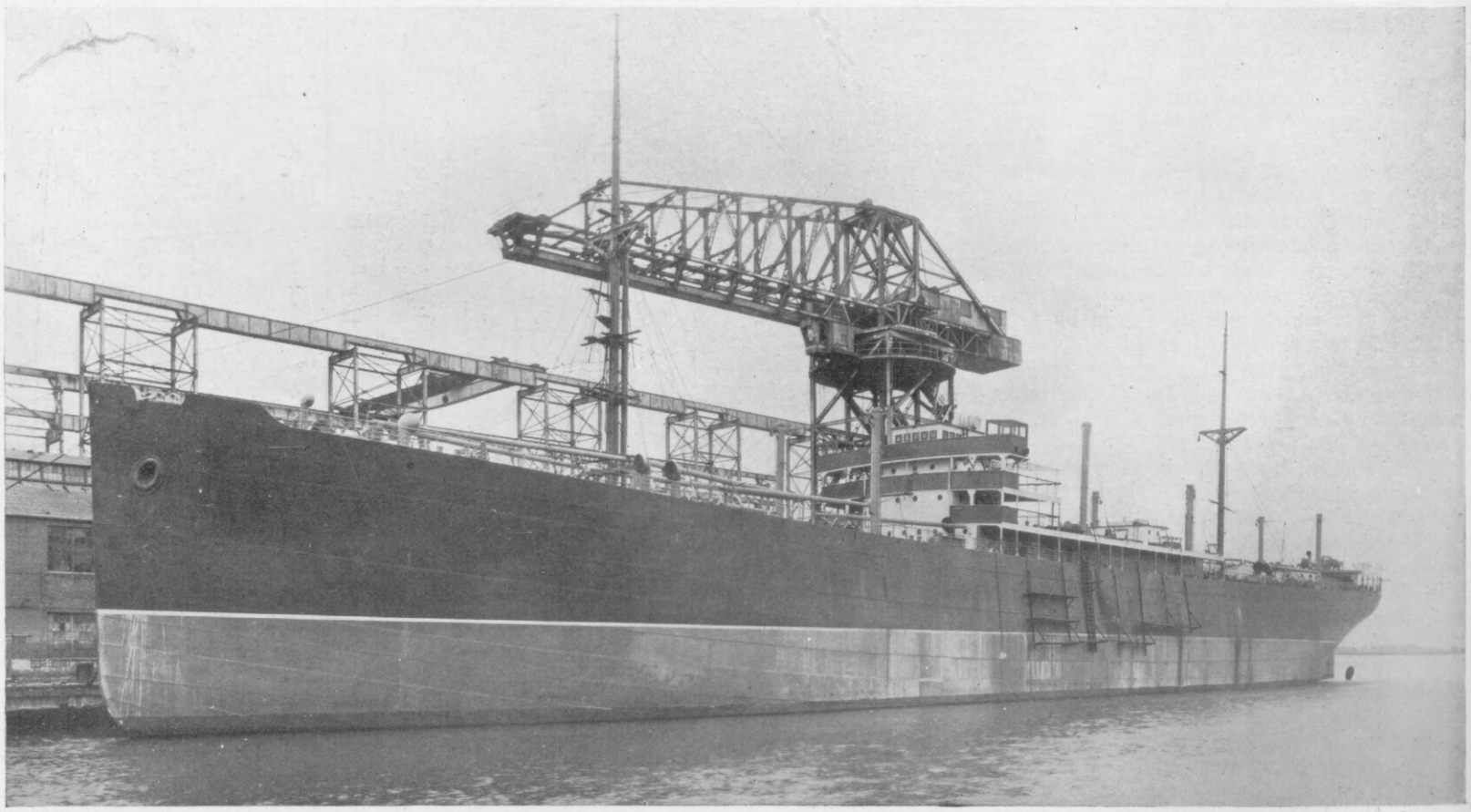
Of course, before any of the new installation work can be taken in hand there is a lot of stripping to be done. The funnel, uptakes, boiler connections, fans and casings, water tube boilers and boiler foundations down to the tank top have to be removed, together with the steam engine and all auxiliary machinery, ladders and gratings, fireroom ventilators, thrust shaft, thrust block, line shafting, propeller shaft, propeller, engine foundation, auxiliary machinery foundations, piping, steam winches, steam steering gear, settling tanks, coal chutes, etc. This will also involve the removal of transverse bulkheads and the closing of all holes and openings left by the removal.

As this is a longitudinally framed vessel with foundation constructed for steam machinery, the inner bottom structure will have to be reinforced to take care of the heavy concentrated loads of the main oil engine and auxiliary generating sets. Due to the higher shaft line of the Diesel installation the shaft line will have to be raised, and this will necessitate raising the top of the shaft alley between the thrust recess and a point about 3 ft. aft of the bulkhead at the after end of cargo hold No. 5. The new thrust bearing will be of the Kingsbury type. A new stern tube will be fitted and provided with oil lubrication, on the McNab-Vista system.

All the deck machinery, including the steering gear, is to be converted from steam to electrical operation. This means the fitting of a 45 hp. motor with compound gearing to the windlass and installing a 25 hp. electric motor with gearing to operate the steering gear. Ten new Lidgerwood cargo winches driven by 25 hp. Westinghouse motors will be installed, and there will also be provided a Lidgerwood electric warping winch.

Due to the decision to provide accommodation on these vessels for 11 passengers, a great deal of structural alteration will be incurred in the bridge house. The crew's quarters at present are in the forecastle, and in order to increase the cargo space it is planned to use the space forward for cargo storage and build a deck house on the poop deck for the crew.

With the sailing about Christmas Day of the motorship NICOLINE MAERSK with a full cargo from New York for South African ports, motorship competition against the privately owned American-South African steamer service was inaugurated. It is probable that more motorships will be placed on this service at a later date.



Ford Motor Co.'s vessel East Indian under the big crane at the Sun yard where her Diesel engines are being installed

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Ferryboat James V. Crawford, of which a duplicate has now been ordered

Brockville and Morristown Ferry

A NEW 100 ft. ferry with a capacity for 20 automobiles was recently placed in service between Morristown, N. Y., and Brockville, Ont. Designed by Eads Johnson, naval architect of New York, and built by Kyle and Purdy at City Island, N. Y., she was delivered via the Hudson River and New York State Barge Canal to Lake Ontario. To go through the Canal she was sunk to 7 ft. draft by filling the compartments adjacent to the engineroom with water. This enabled her to get the proper clearance under the Canal bridges. Upon her arrival at Oswego, N. Y., the water was pumped out, and she was taken across Lake Ontario and down the St. Lawrence to Alexandria Bay, where the pilot house was placed in position on the upper deck, after which she was taken to her route between Morristown and Brockville and put on her station.

The JAMES V. CRAWFORD, as she is known, is built of steel, with four watertight bulkheads and with steel beams and stringers for the main deck which is covered with yellow pine sheathed with 1 in. spruce. The deckhouse and pilot house are wood. Her dimensions are:

Length overall	100 ft. 0 in.
Beam over guards	40 ft. 0 in.
Dept molded	9 ft. 6 in.
Draft loaded	5 ft. 6 in.

She is of the double ended type with a propeller wheel at each end, the through shaft being driven by a 180 b.hp. Nelseco reversible engine. For auxiliary purposes she has a 2½ kw. Western Electric Co. lighting set, a 5 hp. gasoline driven auxiliary air compressor and a 2 in. suction centrifugal pump driven by a 3 hp. gasoline engine.

After the JAMES V. CRAWFORD had been in service a little while the owners discovered that with fuel being used only at the rate of about 1 gal. per mile and lubricating oil consumption amounting only to 1 gal. per day, the cost of operating the 180 hp. Diesel engine is considerably less than that of the 65 hp. steam engine in a ferry on the same route.

They have since placed an order for a ferryboat 25 ft. longer and with considerably more power. The new boat with a length of 125 ft. and to be driven by a 300 s.hp. six-cylinder Nelseco airless injection engine, will be built throughout at the Groton Works of the New London Ship & Engine Co.

A Diesel driven ferry is to be ordered for the Great Belt traffic by the Danish State Railways, according to a report from Copenhagen.

Shares of Foreign Trade

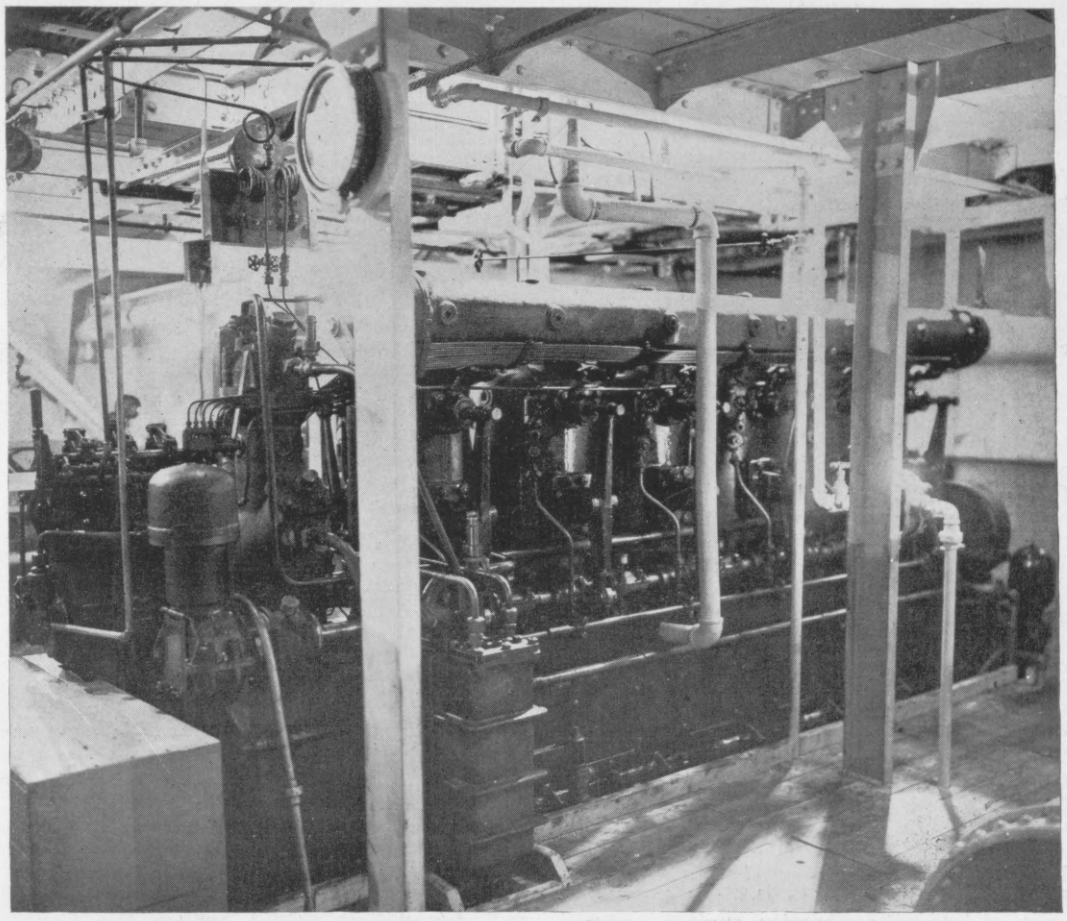
A study of the position of the shipping tonnage engaged in the foreign commerce of the United States brings out certain facts contrary to opinions that have been generally held without any real basis.

In direct trade with various countries American shipping figures highest in the case of our commerce with China, nearly 50 per cent of the total cargo tonnage of which we carry ourselves. The figure is lowest in our trade with Norway, of which American vessels carried less than 4 per cent of the total cargo tonnage.

In our trade with the British Empire, which is by far the biggest portion of our foreign commerce, American vessels carried 42 per cent of the total cargo tonnage and British vessels 48 per cent, the remaining 10 per cent being distributed among vessels of 19 other nations.

The countries handling the largest proportions of the respective direct trade with this country are Norway which carries 63 per cent of its commerce with the United States, Italy which carries 55 per cent and Denmark which carries 52 per cent. All other countries carry less than 50 per cent of their direct trade with us.

These figures are all based on tonnages and must not be confused with other figures sometimes used which are based either on values or on countries of origin of merchandise. These are actual cargo weights.



Machinery installation of the first Brockville and Morristown Diesel-engined ferryboat

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Shipping Board's Annual Report

IN its ninth annual report made to Congress last month the Shipping Board reviews its operations for the fiscal year ended June 30, 1925. It fills a book of 216 pages, measuring 9 in. x 5¾ in., and covers the year's activities of every department of the United States Shipping Board and of the U.S.S.B. Emergency Fleet Corporation.

A summary of the organization and functions of the Board preludes an explanation of its policies and the recommendations it makes for the firm establishment of a merchant marine to take care of American foreign trade. Substantially recognizing that the rejection of the Harding bill by Congress has for the present at least shut the door against the transfer of the Government fleet to private operators, the Board pleads for mail contracts for passenger ships and for naval subventions for approved freight and passenger vessels as a partial support for private operators. If it be the purpose of Congress to maintain the merchant marine as its own, it is warned by the Board that:

"Congress must face the problem of replacements. Merchant ships will eventually become obsolete. The development of internal combustion engines has brought about a radical change, which means that within a few years the bulk of a great Government-owned merchant fleet will be out of date."

Bearing upon the sales of Government Lines effected during the last year, the report observes:

"The subject of replacements to succeed the existing merchant fleet of the Government, whether sold to private parties or whether their operation in part is continued by the Government itself, has been considered. Any policy based solely upon the assumption that a guarantee of service attached to the sale of a line is any assurance whatever of the permanent continuance of the service, when the guarantee does not include a provision for replacement of the vessels, is an illusion in so far as it affects the permanent upbuilding of the American merchant marine. A buyer may guarantee the operation of a route for a period of time named in his contract when the sales price of the vessel, because of the guarantee, is low enough to offset deficits accruing during the period, for the vessel will remain an asset at the expiration of the time and can then be sold at its market value free of the guarantee of service, and the proceeds of sale may exceed the deficits.

"Unless profitable in itself as an operating proposition and sufficiently profitable to justify replacement of vessels, the route will obviously be dropped, so far as the American flag is concerned, at the end of the time, and the only function the sale, though with the guarantee, has discharged has been that of the liquidation of the line as an asset of the Government and not in the least a constructive factor in the permanent upbuilding of the merchant marine."

Relative to the Diesel conversion program the Board states:

"In addition to the vessels in respect to which work is now in progress, the conversion of other vessels will also be undertaken in due course. It is not intended to duplicate the type of engines now under construction until actual experience has been had with each of these types and their possibilities and relative desirability have thereby been adequately demonstrated. Owing to the rapid development of internal-combustion engines and the fact that other desirable types will soon be introduced in this country, the conversion of four vessels in addition to those enumerated above may be undertaken in the near future. When the work on these vessels has been completed and tests have been made as contemplated, the board will then be in a position to definitely determine which types of engine we desire to install in other vessels which may be converted, all which vessels will probably be cargo ships, although some of them may be tankers; the cost of conversion will be approximately the same in either case.

"It is difficult to estimate when the last ship of the entire program will be completed, as it is uncertain what lapse of time may occur between finishing the present program and the active initiation of work on the balance of the entire group of approximately 50 ships. It is believed, however, that as a result of the experience gained by engine builders in the present program, when work is started on the remainder of the ships much more rapid progress will be made, and possibly at lower cost per vessel, as the builders will have obtained valuable manufacturing cost records and shop experience under the present program.

"Much interest is evidenced by private persons in the present program of the Government, as all operators of vessels recognize that efficient internal-combustion propulsive machinery has great advantages over the old-type marine engine because of the great saving in fuel through the higher efficiencies obtained and the further reduction in operating costs, due to the engine-room staff being substantially reduced in numbers, in addition to which, the problem of bunkering is greatly reduced."

Of the $25,000,000 allotted to the Diesel fund by the act of June 6, 1924, the sum of $8,550,222 has been transferred for the program at present in hand.

Part II of the report covers the work of the Emergency Fleet Corporation and embraces the financial statements of the general comptroller's department, including a balance sheet and profit and loss statement. For these details we refer the reader to the Annual Report. There are set out the operating revenues and operating expenditures, between which exists the large spread that calls for an annual appropriation by Congress.

A perusal of the book is recommended to all, because it shows that the Board and its operating subsidiary, the Fleet Corporation, are doing as good a job as any Government department can be expected to do. Most of the criticism directed against the Government merchant marine is based upon ignorance of the difficulties which one Congress after another has heaped upon the Board.

Panama Canal Toll Revenue

HOW the change in tolls proposed by the Panama Canal authorities would affect the Canal revenue and the vessels of different nations is indicated in the table below, comparing the actual revenue of the Canal for the month of July, 1925, and what it would have been if the proposed change had been in effect.

At present, tolls are collected at rates of $1.20 per net ton for laden vessels and 72 cents per net ton for vessels in ballast, computed on the basis of the Panama Canal rules of measurement, with the provision that tolls shall not exceed $1.25 per ton nor be less than 75 cents per ton as determined in accordance with the United States statutes relating to net registered tonnage. In order to ascertain the proper toll charges, it is necessary therefore that the net tonnage of vessels transiting the Canal be determined both in accordance with the Panama Canal and the United States rules of measurement.

To eliminate the present dual system of measurement and computation of tolls, the administration has been endeavoring to have the Panama Canal rules of measurement made the sole basis for the computa- of tolls, with rates per net ton of $1 for laden vessels and 60 cents for vessels in ballast. Tolls assessed on the basis of the Panama Canal rules of measurement at the proposed rates would be substantially the same as tolls actually collected under the present dual system of measurement.

Steamship owners have made a request for a reduction of the tolls to 80 cents per net ton for laden vessels, and Colonel Walker, Governor of the Canal, has promised to examine the possibiiity of recommending the cut. There seems little likelihood it could be put into effect at present, because it would reduce the Canal revenue about 20 per cent, whereas the change proposed by the Canal administration would actually increase revenue. If the Canal is to be kept open for transit throughout the whole 24 hours of each day, as steamship owners are demanding, the operating expenses would be increased, and that assuredly is not the best occasion for reducing tolls.

It may be added that the increased revenue shown from vessels of United States registry, in the table below would have been apportioned as follows, in respect to the channels of trade in which the vessels were engaged:

U. S. intercoastal trade..$9,235.71 increase
U. S. foreign trade..... 1,567.63 increase
U. S. Canal Zone trade.. 440.45 decrease

Effect of Proposed Toll Changes Shown for July, 1925

Nationality	Tolls Actually Collected Under Present Dual Sytem	Tolls Under Proposed Rates of $1 Laden and 60c. Ballast Panama Canal Net	Difference Increase	Difference Decrease
Belgium ...	$7,941.25	$8,445.00	$503.75	.....
British	502,083.03	517,380.80	15,297.77	.....
Chilean ...	8,738.75	9,377.00	638.25	.....
Colombian..	306.68	272.40	.....	$34.28
Danish	18,150.51	16,541.80	.....	1,608.81
Dutch	43,452.31	44,849.80	1,397.49	.....
Ecuadorian..	368.40	307.00	.....	61.40
French	29,679.25	29,978.00	298.75	.....
German ...	58,740.00	66,973.00	8,233.00	.....
Greek	2,913.84	2,428.20	.....	485.64
Honduran...	1,528.80	1,274.00	.....	254.80
Italian	30,316.25	29,055.60	.....	1,260.65
Japanese ..	54,045.35	51,648.40	.....	2,396.95
Jugo-Slavic.	11,361.25	12,119.00	757.75	.....
Norwegian..	67,667.43	66,469.40	.....	1,198.03
Panaman ..	7,020.05	7,738.20	718.15	.....
Peruvian ..	16,031.42	21,847.60	5,816.18	.....
Spanish ...	10,819.89	10,610.20	.....	209.69
Swedish ...	18,089.37	18,654.60	565.23	.....
United States	910,985.91	921,348.80	10,362.89	.....
Totals...	$1,800,239.84	$1,837,318.80	$44,589.21	$7,510.25

Of course the real cost of the Panama Canal tolls is its incidence on the cargo. A vessel with her holds almost empty is out of luck, because the cost per ton of cargo will then be high. The actual cost is a minimum in fully loaded vessels.

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W. H. Hoodless, one of the latest additions to the Philadelphia towboat fleet

14½ Knot Freighter

That the tendency of the big lines is still leading towards higher speeds for freight vessels is exemplified in the new motorship UPWEY GRANGE recently completed for the Houlder Line of London. This vessel, which has been built for the chilled meat trade between the River Plate and the United Kingdom, measures 430 ft. b.p., 62 ft. 3 in. breadth and 38 ft. 3 in. depth to the shelter deck.

Designed for a service speed of 14½ knots she attained a mean speed of 16.2 knots on a double run over the measured mile. She was probably in a light condition, but the performance was excellent. She has seven cargo holds and two 'tween deck spaces, with insulated compartments of a capacity of about 500,000 cu. ft.

In line with modern practice the quarters for the crew are situated amidships on the shelter deck. The accommodation for the deck officers and engineer officers are on the bridge and boat deck, where there are also 12 single berth staterooms for passengers.

For driving the twin screws there are two sets of Fairfield Sulzer engines of similar size and design to those in the AORANGI. Each engine has six-cylinders about 28 in. diameter and 39 in. stroke. Together they develop 6,400 s.hp at 117 r.p.m.

Latest Johnson Liner

ANNIE JOHNSON, built by Götaverken for the Johnson Line's service between Sweden and Pacific Coast ports of North America was completed about the end of November and loaded in the Baltic for the Pacific Coast. She is a sistership to the AXEL JOHNSON delivered in August by Götaverken. The carrying capacity of these ships is 7200 tons, and two Götaverken-B. & W. longstroke engines with cylinders 23.23-in. diameter and 47.24-in. stroke, developing 3500 i.hp. at 120 r.p.m. drive them loaded at a speed of 12½ knots. There are nicely fitted accommodations for 30 first class and 30 second class passengers, and the vessels have 50,000 cu. ft. cold storage space for fruit cargoes. The Johnson fleet (Rederi A/B Nordstjernan, of Stockholm) now consists of 14 motorliners.

A Philadelphia Tug

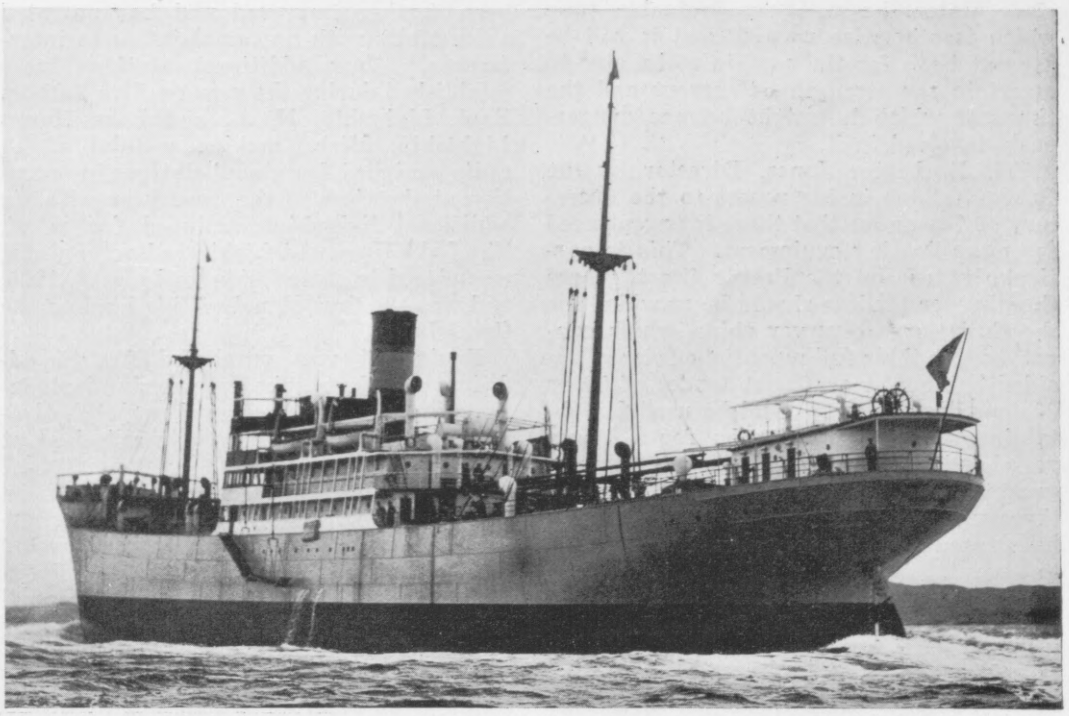
W. H. HOODLESS is a steel towboat owned and operated by Capt. S. C. Lovelands of Philadelphia, Pa. She measures 86 ft. on deck and 79 ft. on the water line, with 20 ft. molded breadth and 10 ft. 6 in. molded depth. Her engine is a 360 hp. Fairbanks, Morse six-cylinder motor, driving a 4-bladed steel propeller of 72 in. diameter and 58 in. pitch. She was built by the Mathis Shipyard, Camden, N. J. where the main installation work was also carried out. A 9 kw. generator set driven by a 15 hp. Fairbanks, Morse engine supplies power for the electrically driven pumps. The bilge and fire pump is of the centrifugal type with a 3 in. inlet and 2½ in. discharge, capable of pumping against 50 ft. For the fuel oil transfer there is a small electrically driven pump of the type built by the American Machine & Foundry Co., with 1½ in. inlet and 1 in. outlet. For the lighting a 2½ kw. Delco set is used. On deck the only electrical equipment is the hawser puller, built by the American Engineering Co. and driven by a 5½ hp. Diehl electric motor.

On account of big losses incurred in the private operation of the Palmetto Line by the Carolina S.S. Co. of Charleston, S. C., and the consequent inability of the company to face the continuance of the service, the Shipping Board has resumed possession of the Line and of the six steamers that were sold with it. Reports state that British and German companies, by placing additional ships on the route with numerous sailings, had been getting a larger share of the business between the South Atlantic range, United Kingdom and North European ports. The Carolina S. S. Co. has been appointed managing operator.

Congress is at last to be requested by the Shipping Board to authorize the construction of two large passenger vessels to supplement the limited number of ships of this class now under the American flag. They are particularly needed for the transatlantic service to operate in the same service as the LEVIATHAN. Plans and specifications were prepared two years ago for ships 726 ft. overall length with a speed of 20 knots, accommodation for 1600 passengers and a displacement of 44,500 tons. In other words these liners, which are to be Diesel engined, will be of about the same size as the AUGUSTA now building for the N.G.I., namely about 30,000 tons gross.

Alterations to Lochgoil

In order to suit her for the increased traffic in fresh fruit between the Pacific Coast and the United Kingdom, the motorship LOCHGOIL recently underwent alteration and improvement at the Harland & Wolff yard, Belfast, where she was originally built. Additional hold spaces were insulated and extra refrigerating machinery installed, to take care of the increased refrigerated capacity provided. She was built for the Royal Mail Steam Packet Company and completed in 1922. Her gross tonnage is about 9500, and she has a deadweight capacity of about 12,400 tons. Her machinery consists of two 8-cylinder Harland & Wolff engines of about 4600 s.hp. which have been reported as operating very successfully.



Annie Johnson, a new Swedish motorship, operating to Pacific Coast ports

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Coast and Geodetic Survey

IN THE annual report of the U. S. Coast & Geodetic Survey for the fiscal year ended June 30th, 1925, there are many indications of the manner in which the important work of this department is handicapped by lack of money. The Coast & Geodetic Survey, a branch of the Department of Commerce, is principally concerned with the collection and dissemination of information of aid to the mariner. It prepares the coastal charts and issues the tide tables. Although the work has been carried on for 109 years, the first complete survey of the U. S. coasts has not yet been completed.

Charts already issued contain probably more than 100,000 miles of shore line, but there are areas still unsurveyed or only partly surveyed along the coasts of California, Oregon and Alaska. Charts already made have to be kept constantly up-to-date. Those of the important ports along the Atlantic and Gulf Coasts are reprinted from four to six times a year, and the average frequency of printing of all charts issued by the Bureau is twice per annum.

When the charts come off the press the further corrections received since the printing was begun are inserted by hand. During the fiscal year 1925 over one million such hand corrections were made. This gives an idea of the efforts made by the Bureau to ensure the greatest possible accuracy in the nautical charts issued by the United States.

In later years the increase in size and cost of the deep draft vessels of marine commerce has increased the need for more detailed guidance to mariners concerning the tide and currents in the North American harbors. Surveys of the tides and currents have recently been made in New York Harbor, San Francisco Bay and Delaware Bay. One is now being made of the inside passages of South Eastern Alaska. The need for the current and tide survey of the narrow passes on the inside route to Alaska has long been felt by shipping interests in the Pacific Northwest. When the mariner can know in advance the time of slack water, he will save valuable time which is otherwise wasted, and it will be a great boon for the captain to be able to ascertain the strength of current and the times at which he might become dangerously involved in it.

Col. E. Lester Jones, Director of the Bureau, states in his report to the Secretary of Commerce that there is urgent need for more floating equipment. This is particularly true on the Pacific Coast, where three power tenders should be provided for the three largest survey ships, which cannot develop their full potential efficiency unaided by smaller craft. A tender of 50 or 60 tons displacement could be used for obtaining advance information for a larger vessel and enable the survey to proceed with greater speed. At one time the Bureau had three such tenders, but two of them had to be scrapped because they were dangerous to operate, and the third has just about reached that condition.

At the present time the Pacific Coast has three modern seaworthy vessels acquired from the Navy two years ago in addition to a vessel built by the Bureau just before the war and still very serviceable. They are stated to be costly to operate because of the quantity of fuel required to drive them. If converted to Diesel engine power their conversion could save money in the long run.

On the Atlantic Coast the Bureau has only two small wooden steamers which are reported unsafe in heavy weather and a larger vessel which is still seaworthy. One modern vessel of 600 tons displacement equipped with oil engines could perform the work of the two old vessels at a considerable saving, and could be employed on work which neither of them can undertake because of their unseaworthiness.

A notable prediction is made by Col. Jones in that part of his report dealing with the present demands for hydrographic work. He states that it has been proven beyond the question of a doubt that instruments for measuring depth by sound are practicable and it is only a matter of time before they will be in general use on all vessels of the world. This requires the Bureau to increase the detailed knowledge of the character of the bottom surveyed by it.

Operation of the American Republics Line, the Shipping Board service between New York and the east coast of South America, will be transferred at the end of January to Moore & McCormack, the International Freighting Corporation, which has been operating the steamers, having decided to give up the management. Moore & McCormack have been connected for a number of years with the South American shipping business.

Work of Bureau of Lighthouses

AN INCREASE in the number of aids to navigation, the completion of much needed engineering works and an improvement in apparatus and equipment, are cited among the outstanding accomplishments of the Lighthouse Service for the fiscal year 1925, in the annual report submitted by Commissioner George R. Putnam to Secretary Hoover.

The Lighthouse Service maintains 17,864 aids to navigation, according to the report, of which 6352 are classified as lighted aids, 1207 as fog signals, and 10,573 as unlighted aids. This is an increase of 581 over the number reported last year, notwithstanding the discontinuance of nearly 700 aids during the year. Automatic lights were installed in 74 stations, making a total of 993 lights of this character, in addition to 723 buoys with automatic light.

Radio fog signals have especially won commendation in shipping circles, Mr. Putnam states, and important progress has been made during the year in the extension of their use in navigation. The continuous wave tube transmitter placed in service on Ambrose Channel Lightship in 1924 has been further improved and has operated successfully with no complaint as to interference. Two additional stations were established during the year on Five Fathom Bank Lightship, N. J., and Lake Huron Lightship, Mich., making a total of 13 radio equipped fog signal stations in operation at the close of the fiscal year with six additional lightships equipped for relief. The Lake Huron Lightship radio fog signal was placed in commission on June 12, 1925, and was the first signal of this kind on the Great Lakes.

Equipment was purchased for 15 additional modern tube type radio installations for signal stations, and work is actively in progress on the new installations at these stations.

In addition, special equipment has been purchased for the purpose of testing the usefulness of radio fog signals in congested waters, such as Long Island Sound. Progress has been made in the work of increasing the efficiency of radio fog signals by synchronizing the signals emitted from adjacent stations by the use of special control clocks so as to avoid overlapping of neighboring stations and thus make signals clearer.

Since October, 1924, the radio fog signal on Nantucket Lightship has been operated for 15 minutes out of every hour, day and night regardless of weather conditions, thus providing a signal for long distance bearings in approaching the American coast and also facilitating the testing of apparatus. The number of ships equipped with radio direction finding apparatus has materially increased, and favorable reports have been received of the value of this system in safeguarding and facilitating navigation. No vessel can pretend to be modern when not equipped with a radio compass.

Progress is also reported in the extension of the automatic system of operating lighted aids. During the year automatic lighting apparatus was installed at 74 stations. At the end of the fiscal year the total number of automatic lights on fixed structures in commission was 993 (not including some partially automatic), and in addition there were 723 buoys with automatic lights, or a total of 1,716 in the Lighthouse Service.

Important new construction work and major improvements during the year included further progress on Cape Spencer, Alaska, light and fog signal station, which went into commission November 20. Other works under way are a lighthouse on Martin Reef, northern part of Lake Huron, to take the place of a lightship, an important light and fog signal station on Milwaukee Breakwater, a new lightship for the Atlantic Coast, and two lighthouse steamers for the Mississippi River.

Last month the American South African Line of the U. S. Shipping Board was sold to John M. Franklin, as agent for a corporation to be formed under the laws of the State of New York. The buyer has guaranteed operation for a period of five years, with not less than 12 voyages per year, in the South and East African service. Five steamers, averaging about 8600 tons d.w. each, changed hands in the transaction for a total sales price of about $780,000. John M. Franklin is a son of P. A. S. Franklin, chairman of the International Mercantile Marine.

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Chief Engineer Honored

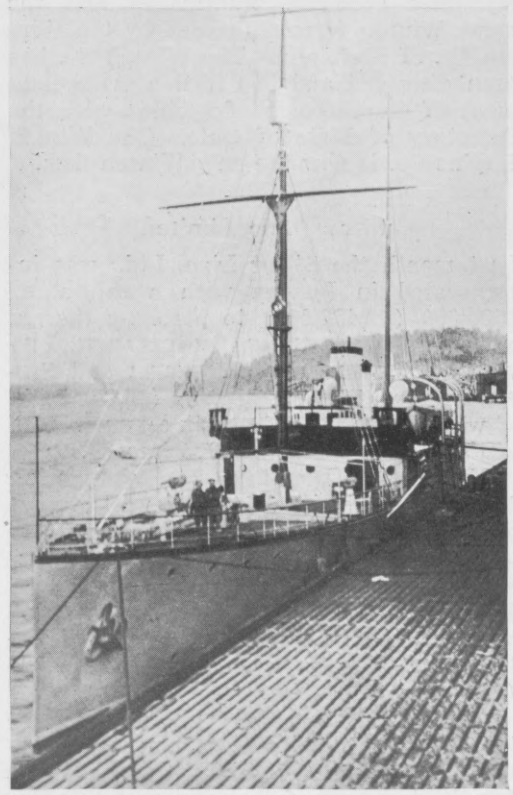
A gold watch has been presented to C. Hansen, chief engineer of the motor tankship OLJAREN, for his meritorious operation of her engines during a 20 months' time charter, when only one cylinder cover was lifted and that just for the purpose of renewing some piston rings. During the charter 530 days were spent at sea and 135 days in port. When it expired she was sent to the builders' yard for overhaul and for engine inspection. Her machinery was found to be in excellent condition. That fact, in conjunction with the clean record of the 20 months' charter, led to the presentation made to the chief by the engine builders.

OLJAREN, which was completed in 1922, is owned by the Rederi A/B Transatlantic, of Gothenburg, and is a tanker of 7700 tons d.w.c., measuring 5482 tons gross, with registered dimensions of 389.7 ft. by 54.9 ft. by 29.7 ft. Her propelling machinery consists of two Götaverken-B. & W. six-cylinder engines, with cylinders 23.23 in. diameter and 35.43 in. stroke, turning at 140 r.p.m. and developing together about 2100 s.hp., giving the ship a mean sea speed of 10½ knots when loaded. Her auxiliary machinery, including cargo pumps, is all electrically driven.

WARRIOR, formerly the VANADIS and now owned by G. Harrison Williams, has had her stern built up as shown in the accompanying illustration. The space in question is lighted by large openings in which shutters are fitted with deadlights. For coastwise cruising the shutters are omitted, being used only for offshore work. It is proposed ultimately to make use of the additional space on the main deck aft for extra accommodations. The alteration has added greatly to the appearance of the yacht, and the new sheltered space provided has also considerably increased the comfort of the quarters. The alterations were carried out under the supervision of Cox & Stevens.

New Engines for M.Y. Ara

W. K. Vanderbilt's motoryacht ARA arrived home last month after having new engines installed by the A. B. Finnboda Varv. Originally she had 6-cylinder 2-cycle Polar engines with dimensions 17.71 in. by 21.25 in., which developed 825 s.hp. at 165 r.p.m. These engines, which were installed in 1918, have now been replaced by improved engines of the same make with six cylinders of 16.54 in. diameter and 28.35 in. stroke, which at 150 r.p.m. develop about the same horsepower. An illustration on this page shows the ARA lying at the Finnboda shipyard.



M. Y. Ara in Swedish waters

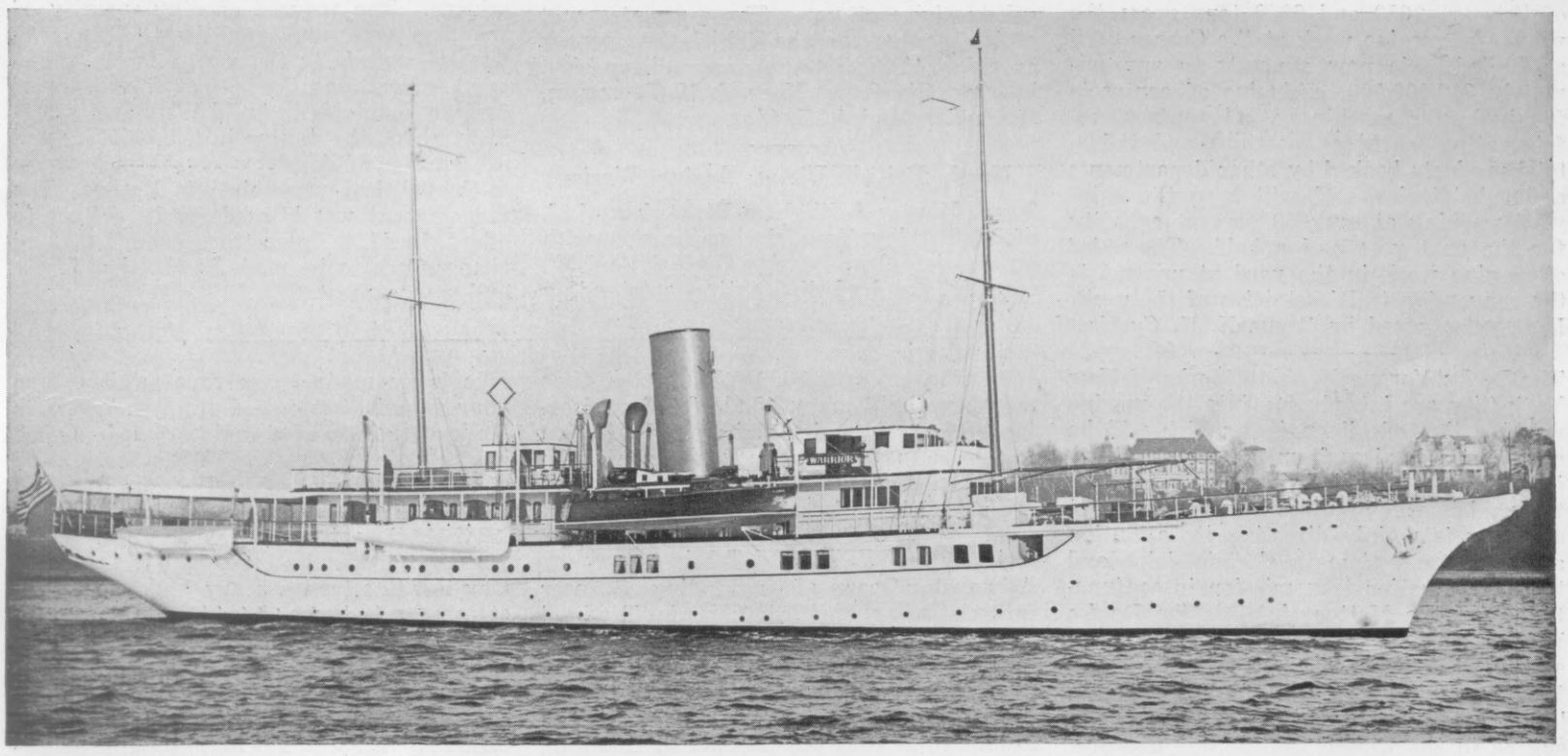
Diesel Engines for Cruiser

Diesel engines are to be used for cruising speeds in the new British 7000 ton minelaying cruiser ADVENTURE. She is the first specially designed minelayer for the British Navy and will also be the first British warship to use Diesel engines for propulsion. It is true that during the war there were a certain number of monitors built which had oil engines installed, but the power provided was so low that it scarcely gave steerage way. For this information we are indebted to the *Oil News* of London.

One European ship and engine building company has sent us a list of 15 large Diesel motorships and six Diesel yachts they have engined for American ownership. The ships aggregate 184,429 tons d.w. and are fitted with 27 main Diesel engines totalling 41,650 s.hp., while the yachts have 12 Diesel engines of 3,880 total s.hp. Three of these ships were built prior to the war and have been converted from steam power. The remaining 12 vessels and the six yachts represent new construction.

Rotterdam Lloyd Liner

A new passenger liner of bigger dimensions than the INDRAPOERA has been ordered by the Rotterdam Lloyd Company. She is to be called the SIBAJAK and will be built at the Schelde yard at Flushing, Holland. Her gross tonnage will be in the neighborhood of 13,000 tons and she will have accommodation for 523 passengers. She is to be 530 ft. long, 62 ft. 6 in. beam and 37 ft. 11½ in. depth. For propulsion she will have two 8-cylinder Sulzer engines with 29.92 in. cylinder diameter and 52.76 in. stroke, developing about 7000 s.hp. aggregate at 90 revolutions per minute. These engines are of the same dimensions as those installed in the INDRAPOERA now being completed for the same owners and have considerably bigger cylinder dimensions than the AORANGI engines, but turn at a slower speed.



M. Y. Warrior (ex Vanadis) as she appears today after having had her stern built up to secure extra sheltered space

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What the Viking Pump Company understands by service was exemplified recently by the aeroplane delivery it made of a rotary pump. An urgent call was sent by a Chicago customer and the factory at Cedar Falls, Iowa, shipped the pump by aeroplane, permitting the Chicago customer to carry out the program he had scheduled for the same evening.

Chicago Pneumatic Tool Company has effected arrangements with Grossmotoren-Werke of Mannheim and Hamburg, Germany, whereby it has acquired the exclusive right to manufacture and sell the Benz airless injection engine in the United States and Canada. No decision has yet been taken about the building of marine engines of this type in this country, but the stationary line will be suitable for ship's auxiliaries.

The American Engineering Co., of Philadelphia, manufacturer of machinery for ship control, cargo handling, refrigeration and other industrial purposes, announces that its interests in Canada have been taken over by the Affiliated Engineering Companies, Ltd., with headquarters in the Southam Building, Montreal. M. Alpern, President of the American Engineering Co., is chairman of the board of the new company and F. S. B. Heward is president.

More business on hand at the present time than ever it has had in its history is reported by the Atlas-Imperial Engine Co., Oakland, Cal., and the firm is confronted with the problem of erecting another machine shop to take care of the increasing business. Plans are being made for a new office building which will be four times the size of the present office. "In other words, business is good, and we are forging right straight ahead," says A. Warenskjold, President.

With the award of a contract by the Eastern Steamship Company for a vessel of between 7000 and 8000 tons gross the volume of marine work at the Cramp yard at Philadelphia now amounts to approximately $10,000,000, exclusive of contracts for hydraulic machinery, oil engines, refrigerating machines, castings and industrial products booked by other departments and subsidiaries, and will keep the shipyard working at over 60 percent capacity for the next year and a half. The chief oil engine work in the yard at present is the conversion to Diesel drive of the yacht LYNDONIA owned by Cyrus H. K. Curtis.

The De La Vergne Machine Works of New York City are introducing into the marine world a line of oil engines which will be constructed in sizes from 200 to 1,000 b.hp. in three to six cylinders. While some of the models will be directly reversible, the company is mainly directing its attention at the present time to electric drive and to gear reduction transmission in conjunction with the Metten clutch. The De La Vergne Machine Company, which is a subsidiary of the Wm. Cramp & Sons, Ship and Engine Building Co., of Philadelphia, licensees of the Burmeister & Wain Diesel engine in the United States, was the first firm in the United States to build an oil engine, having taken up the Hornsby-Akroyd patents in 1893. Since that time they have built many hundreds of surface-ignition, air injection and airless injection engines. In all recent models air injection has been abandoned, and at present they are using the airless injection exclusively.

A naval officer, after reading Spencer Miller's essay entitled "Elastic Towing" writes from the China Station to Mr. Miller, in part as follows—"I see daily in a small way a hundred examples of 'Elastic Towing.' High Chinese junks, which form an endless procession up the river at this time of the year, are towed by dozens of coolies who trudge along the bank. Their tow line is a home made grass rope smaller than your thumb, but is led through a snatch block at the top of a well seasoned, supple, but elastic foremast. When the junk strikes a swift bit of current the foremast bends like a Bristol rod and the impression is that they have "hooked a big one." Recently a Standard Oil man watching a tiny tow line haul a heavy junk up a swift stream, asked me how John Chinaman could put so much faith in a shoe string and get away with it. My reply was 'Elastic Towing.' The Lidgerwood Manufacturing Co. will send out this essay of Spencer Miller's, "Elastic Towing" to anyone requesting it. It contains valuable information for anyone interested.

Financial Notes

Winton Engine Co.

A formal change in organization has been made by the transfer to the Winton Engine Company of Cleveland, O., of the assets, including goodwill, trademarks and the name Winton formerly owned by the Winton Co. of Cleveland. The Winton Co. has been dissolved and has filed a relinquishment of its corporate franchise with the Secretary of State of Ohio. The Winton Engine Co. is now the only Winton firm.

Silver Line Limited

Last month the Silver Line, Ltd., was incorporated in London with a capital of £500,000 ($2,430,000) to purchase the six motorships SILVERPINE, SILVERLARCH, SILVERELM, SILVERCEDAR, SILVERFIR and SILVERRAY for a total of £685,918 ($3,333,561), of which £384,543 is to be in common stock of the company and £301,375 in cash.

Six further Diesel vessels aggregating 31,488 tons gross and 54,000 tons d.w. have been contracted for with British builders to be fitted with Doxford engines of 6,000 hp. giving the vessels a speed of 14½ knots. The cost of the hulls will be £624,462 and of the engines £515,538, or a total of £1,140,000 ($5,540,400) representing £190,000 ($923,400) per ship.

Under the authority of the Trade Facilities Act the British Government guaranteed £1,107,000 ($5,380,020) to the Line for the building of the new vessels. The Silver Line, Ltd., offered for subscription an equivalent amount of 5 per cent debenture stock carrying the government guarantee of principal and interest. The amount was oversubscribed at once. Actually the assistance furnished by the British Government in this case amounted to an endorsement of the company's bonds, thereby enabling the line to obtain the money from the public on a 5 per cent basis, and the public quickly snapped up what was virtually a 5 per cent Government bond issued substantially at par. The guarantee will probably never cost the British Government anything. The directors of the Silver Line, Ltd., are Sir James Marr, S. M. Thompson, H. F. Kerr and A. E. Clegg.

North British Diesel Engine Works

Swan, Hunter & Wigham Richardson, Ltd. of Wallsend-on-Tyne, in conjunction with an associate firm, Barclay Curle & Co. Ltd., recently acquired the entire outstanding stock of the North British Diesel Engine Works, Ltd., of Glasgow, which is building a 2-cycle double-acting engine in addition to its 4-cycle single-acting type. The North British Diesel Engine Works, Ltd., has been liquidated, and the plant has been transferred to Barclay Curle & Co. The old engine works of the latter company will be closed and at a later date the old boiler shops will also be shut down. The construction of steam engines and the boiler making will be transferred to the spacious shops formerly used by the North British Engine Works, where the building of Diesel engines will also be continued.

A. B. Götaverken

During the year ended June 30, 1925, the A/B Götaverken of Gothenburg, the largest and most important shipbuilding and marine engineering company in Sweden, made a profit of 877,287 kr. ($235,113). This compares with a profit of 1,056,802 kr. ($283,223) during the previous fiscal year.

Vickers, Ltd.

A drastic reduction in the capital of Vickers, Ltd., was announced last month. The scheme for reconstruction was drawn up by three financial experts, including Reginald Mc Kenna, former British Chancellor of the Exchequer and chairman of Britain's largest bank. Of Vickers outstanding capital of £20,679,290 there was £12,315,483 in the form of £1 common stock, quoted on the market at the beginning of December at about 7 shillings. This old common stock is to be written down from £1 to 6s. 8d., the shareholders thus suffering a nominal loss of capital of about two-thirds of their shareholdings. By the creation of 24,630,966 new shares of common stock of 6s. 8d. par value the capital structure will be increased to £26,500,000 ($128,790,000). The existing reserve fund of £3,659,216 will be absorbed and used in the reconstruction scheme. The reduced earning capacity of the firm was attributed by the three financial experts to the world cut in armament expenditure, the increased tendency of foreign countries to build their own armament plans, the decline in shipbuilding and a cessation of development schemes owing to the political uncertainty in Europe. The management was blamed for its failure to adapt itself to peacetime operation, and changes are to be made in the directorate and management.

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Three More Golden Gate Ferries

CONTRACTS have been awarded by the Golden Gate Ferry Co. for the construction of three ferries of larger size than those it is now operating on San Francisco Bay. Like the GOLDEN GATE and the GOLDEN WEST, the three new boats will have Diesel-electric drive with complete pilot house control to the electric driving motor. They will be built of Douglas fir throughout, 240 ft. in length overall, 214 ft. long outside the propeller posts, 44 ft. molded beam, 60 ft. beam over the guards and with a molded depth of 6 ft.

Each boat will have three 400 hp. Pacific Diesel engines, each direct connected to a 270 kw. generator with an independent 25 kw. exciter. The current from the three generators will be available for either of the two 900 hp. Westinghouse electric motors, of which there is one at each end of the boat direct connected to the propeller shaft at that end.

These boats will operate in the triangular service between San Francisco, Berkeley and Sausalito. The price quoted by the Pacific Diesel Engine Co. of Oakland was $83,333 per set of three engines. The Westinghouse Electric & Manufacturing Co. was awarded the contract for two sets of electrical equipment for each ferry at a price of $47,700 for each boat. General Engineering & Drydock Co. of Alameda got the contract for building the hulls at a price of $175,750 each. Each of the vessels will cost approximately $350,000. The first boat will be ready about next June, and the two other boats will follow at intervals of one month.

Gulf Refining Co. Will Order Motor Tankship

A motor tankship is to be built in this country for the Gulf Refining Co. While the final details remain to be settled it is reported that the contract for the hull has been secured by the Federal Shipbuilding & Drydock Co., and the order for the Diesel machinery entrusted to the Bethlehem Shipbuilding Corporation. There is a likelihood that the hull will be constructed on the Isherwood new bracketless system.

Indrapoera's Trial Trip

At the end of last month the new twin-screw motorliner INDRAPOERA of the Rotterdam Lloyd made a trial from the Schelde yard at Flushing, Holland, where she was built, to Rotterdam. This was preliminary to the official trial to be held later.

INDRAPOERA is a passenger vessel of about 15,000 tons displacement and 7200 s.hp., her main engines being two Sulzer six-cylinder engines of 29.92 in. diameter and 52.76 in. stroke turning at 90 r.p.m. and driving her at about 15 knots.

On her trial trip, our correspondent states, the engines turned between 82 and 84 r.p.m., and the ship made about 14½ knots with a foul bottom, the hull not having been scraped since it was put in the water about 9 months previously. The engines operated very quietly and at some parts of the ship no sound or tremor from them could be heard. The turbo-blower was responsible for some noise, and in the SIBAJAK a larger ship building for the same company a reversion will be made to scavenge pumps driven off the main engine shafts. In the New Waterway, the narrow channel from the Hoek van Holland to Rotterdam, the engines were kept at 38-40 r.p.m. and at one time were slowed down to 28 r.p.m.

Powerful 2-Cycle Engines

With the placing of an order by the Nederland Stoomvaart Maatschappij, of Amsterdam, for a new twin-screw motorliner of higher power than the P. C. HOOFT, which it has on order, the 2-cycle engine is lifted to a new high mark on the power scale. The P. C. HOOFT, a 16 knot vessel of about 21,000 tons displacement and 8000 s.hp. is having two Sulzer engines with eight cylinders of 26.77 in. diameter and 47.24 in. stroke.

For the new liner the company has selected 10-cylinder engines of the same cylinder dimensions to turn at 100 r.p.m. and develop 5800 s.hp. each. They are to be built by Sulzer's in Switzerland. This choice has no doubt been made in order to have a considerable measure of interchangeability between the machinery of the two ships. Not only will it facilitate the transfer of engineers between the vessels but there will be an advantage in spare equipment. Details of the liner herself are not yet available.

With 11,600 s.hp. the new twin-screw Sulzer engined vessel approaches the quadruple screw 13,600 s.hp. AORANGI in point of power. Her engines, though they will be the most powerful Sulzer engines yet built, will not, however, have the largest cylinders. The Sulzer engines in the single screw BINTANG and in the new twin-screw INDRAPOERA have cylinder dimensions of 29.92 in. x 52.76 in., the engines themselves being six-cylinder sets of 3600 s.hp. at 90 r.p.m., and in the SIBAJAK for the same owners eight-cylinder engines of the same type giving 9600 s.hp. are to be installed.

Harland & Wolff's 1925 Tonnage

Harland & Wolff launched over 100,000 tons of shipping with over 88,000 i.hp. during 1925, which was a year of considerable depression in the shipping business. At the Belfast yard five vessels were launched, four of which were small steamers and the fifth was the large motorliner ASTURIAS for the R.M.S.P. At the Govan yard, where 11 vessels were launched, all were motorships of over 5,000 tons gross each, excepting two small steamers of less than 1,000 tons each. No less than 27 sets of Diesel engines were constructed. Most of the work still in hand is composed of motorvessels and Diesel engines.

Saturnia Launched

With the launching of the hull for the new Cosulich motorliner, SATURNIA, in Italy at the end of last month a further step forward in the size of motorliners was made. She is variously stated to be of 23,500-25,500 tons gross. In point of power she also sets a new mark. Her two engines will deliver 18,000 s.hp. for propulsion.

SATURNIA, which is being built for the direct passenger service between Trieste, Naples and New York is 651 ft. 3 in. long, 79 ft. 6 in. broad and with a depth of 45 ft. 6 in. to the main deck. She is to be decorated in a luxurious manner, and her accommodation will include all modern conveniences and improvements, an outline of which was given on page 523 in the July issue of MOTORSHIP.

Two Burmeister & Wain double-acting 8-cylinder engines will be used for propulsion. They have been built by the Stabilimento Tecnico Triestino and will be more powerful than any of the B. & W. double-acting engines yet built or ordered. It is understood they will be fitted with a supercharging system, to be used only to make up time when the vessel has suffered delay through bad weather. Normally the engines will be run at less than the 9000 s.hp. each which they will be capable of delivering. The keel of the vessel was laid on May 30 last, and her launching in six months represents a remarkable feat of shipbuilding. The slip she has just vacated will be taken up by the construction on her sister vessel the URANIA.

MURJEK, the ninth motorship built by Götaverken for the Grängesberg Company's fleet of ore carriers, ran her trials on a new measured mile outside Strömstad on the west coast of Sweden. This mile has a depth of not less than 100 fathoms and is protected against the open sea by a row of small islands. MURJEK was loaded at the time with her first cargo of about 7000 tons of Swedish ore for America. In this loaded condition the mean speed was found to be 11.3 knots with 2620 i.hp.

Fast Ships for Sicily

For the subsidized service which Florio & Co., of Palermo, have contracted with the Italian government to provide between Naples and Palermo and between Palermo and Tunis, there will be a fleet of four motorships of 5400 tons gross and nine motorvessels of 2000 tons gross. The larger vessels will have twin screws with engines of 6000 hp., giving a maintained sea speed of 16½ knots. The contract trial speed is 18 knots. These vessels, which will be 397 ft. long overall, 50 ft. 6 in. molded breadth and 17 ft. 3 in. draft, will have accommodation for 175 first-class passengers, 145 second-class passengers and a large number of third-class passengers.

Last month the Italian motorship LEME of the Societa de Navigazione Libera Triestina arrived on the Pacific Coast, inaugurating the new service of the Italian Company between the Mediterranean and the West Coast of America. LEME, which is a cargo boat with accommodation for about 35 passengers, measures 450 ft. bp., 57 ft. breadth and 39 ft. depth, with a gross register of 8108 tons and a d.w.c. of 11,009 tons. She is a single screw vessel driven by a Tosi single-acting 4-cycle engine of 2400 hp., with 6-cylinders of 24.41 in. diameter and a stroke of 38.39 in.

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World's Motorship Development in 1925

A Survey of the Past Year's Progress in Motorshipping and of the Present Activities

By A. C. Hardy, B.Sc., A.M.Inst. N.A.

LLOYD'S Register shipbuilding returns for the quarter ending September 30, 1925, show that the total tonnage of motorships under construction in the world exceeds 99 per cent of the total steamship tonnage. This is an increase of 39 per cent over the returns for the quarter ending December 31, 1924, and an increase of 64 per cent over the corresponding quarter of 1923. For Great Britain, the tonnage of motorships under construction for the quarter ending September 30, 1925, is 55 per cent of the steamship tonnage, an increase of 12¼ per cent over the corresponding figures for the end of last year and of just 25 per cent for the final figure of 1923. These points will be noticed on referring to Tables 1 and 2 and Figs. 1 and 2, from which it will also be noted that the above percentages in each case have risen from a zero figure quoted in the returns for December 31, 1913.

In twelve years, therefore, the motorship, from being a negligible quantity, has increased in importance until it now occupies nearly half of the tonnage under construction in the world and nearly a quarter of the tonnage building in the world's premier ship constructing country. It seems not without interest, therefore, to make a brief retrospective survey of the last year's work in the field of marine internal combustion engineering, noting, at the same time, any historical milestones along a road of steady progress.

A detailed examination of the figures quoted in Tables 1, 2 and 3, and shown diagrammatically in Figs. 1, 2 and 3, indicates that, as far as world figures are concerned, although there has been a slight drop in the motorship tonnage under construction for the quarter ended September 30th (1,088,888 gross tons as against 1,129,912 gross tons) in comparison with the quarter ended June 30, there has been a drop also in steamship figures—1,090,456, as compared with 1,212,525 gross tons.

The rate of drop for steam, however, is considerably steeper than that for motors, which helps to account for the gratifying or alarming—according to the point of view from which it is regarded—increase in motorship tonnage under construction. In British shipyards, the increase of motorship construction although gradual, has not been anything like so spectacular, and in the complete year from December 31, 1923, to December 31, 1924, the percentage of motor to steam construction only shows an increase of 2.45 per cent. It is worthy of note, however, that in the period from December 31, 1924, to September 30th of last year the percentage of motor to steam construction shows an increase of 22.25 per cent. This fact is not so much due to an abnormal increase in motorship construction (actually there were 42,590 gross tons of motorships less under construction for the quarter ended September 30th than for the quarter ended June 30th) as to a drop of some 329,724 tons in steamship construction during the last year.

As far as foreign countries are concerned, I have selected three of the Northern European countries most interested in the internal combustion engine, and in Table 3 and Fig. 3 is shown the comparative development of steam and motor tonnage. Denmark* and Sweden* are, of course, small shipbuilding countries when compared with Great Britain or with Germany. Moreover Denmark was among the earliest champions of the motorship, as well as being the home of the Burmeister and Wain engine and of shipowning firms like the East Asiatic Company, who have, in the course of the last 12 or 14 years, replaced practically the whole of their steamship fleet by motorships.

Both Denmark and Sweden have been the marine internal combustion engine's staunchest supporters from the beginning, and for these reasons it is not so surprising to find that the motorship returns for the period under review easily outweigh the steamship returns. The motorship construction for Denmark at September 30th of last year, was just over 17 times the steamer construction, although the September returns show a proportionately greater motorship drop than is the case with the steamer. Sweden shows a steady motorship increase and a steady, though less gradual, steamship decline, the returns for September 30th of last year showing that motorship tonnage now building is just thirteen times the steamer tonnage. A year's increase, from December 31, 1923, to December 31, 1924, shows (see Fig. 3) a steeper motorship increase slope for Denmark than for Sweden, while the Danish steamship decrease slope is also considerably steeper than that of Sweden.

Germany is an interesting case, and a study of her returns would appear to indicate that her appreciation of the motorship's potentialities has been swift. The rise in construction in the period December 31, 1923, to December 31, 1924, is some 138,510 tons. In other words, in a year it almost doubled, and it should also be remembered that on December 31, 1923, the steamship tonnage exceeded the motorship tonnage by 52,262 tons. The latest figures for German shipyards indicate a distinct downward tendency in motorship tonnage under construction as well as a slight fall in steamer tonnage. Of course, even allowing for the present abnormal state of depression of shipbuilding throughout the

*Denmark has 10, and Sweden has 11 establishments capable of turning out ocean-going motorships and steamships and their machinery.

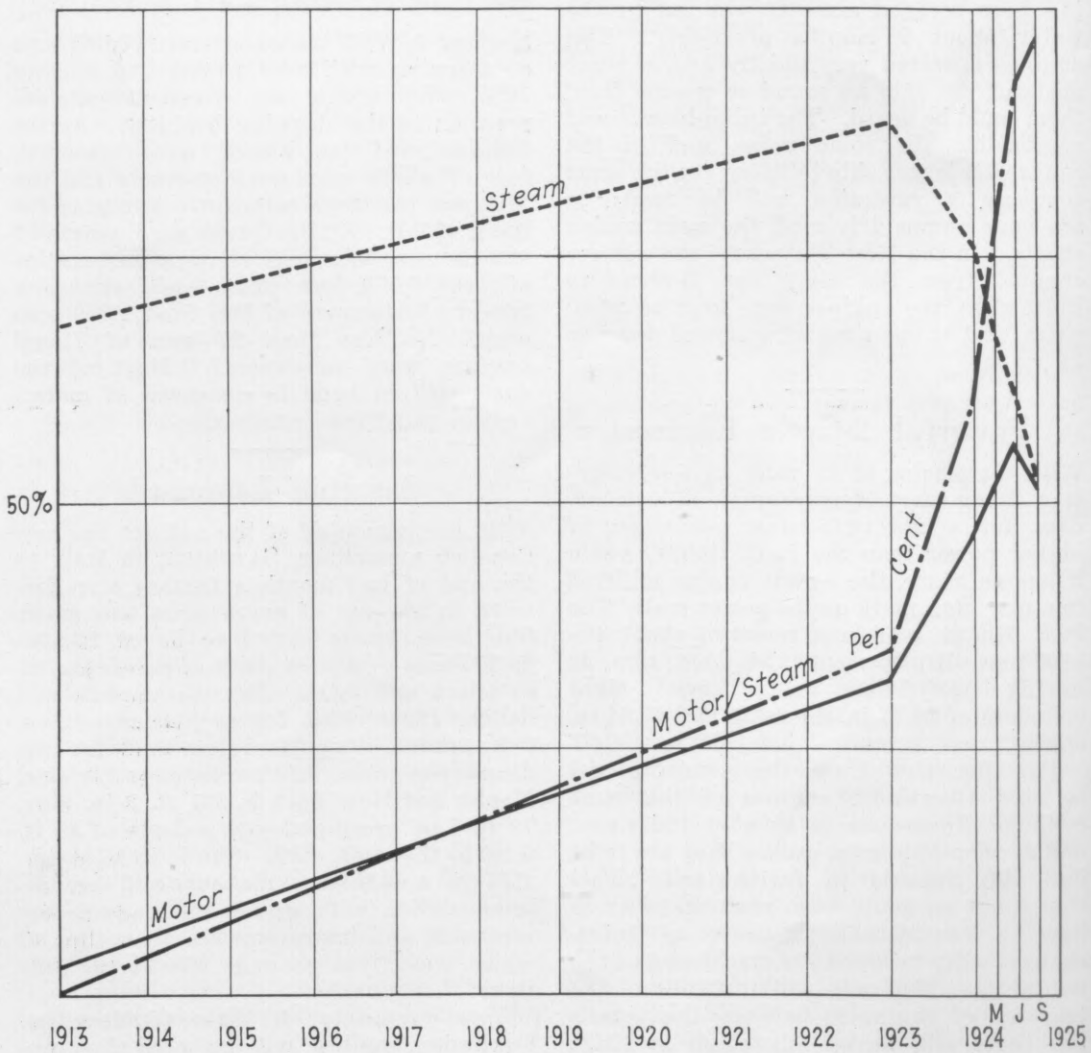

Fig. 1. Motorships and steamers under construction in the world from 1913 to 1925

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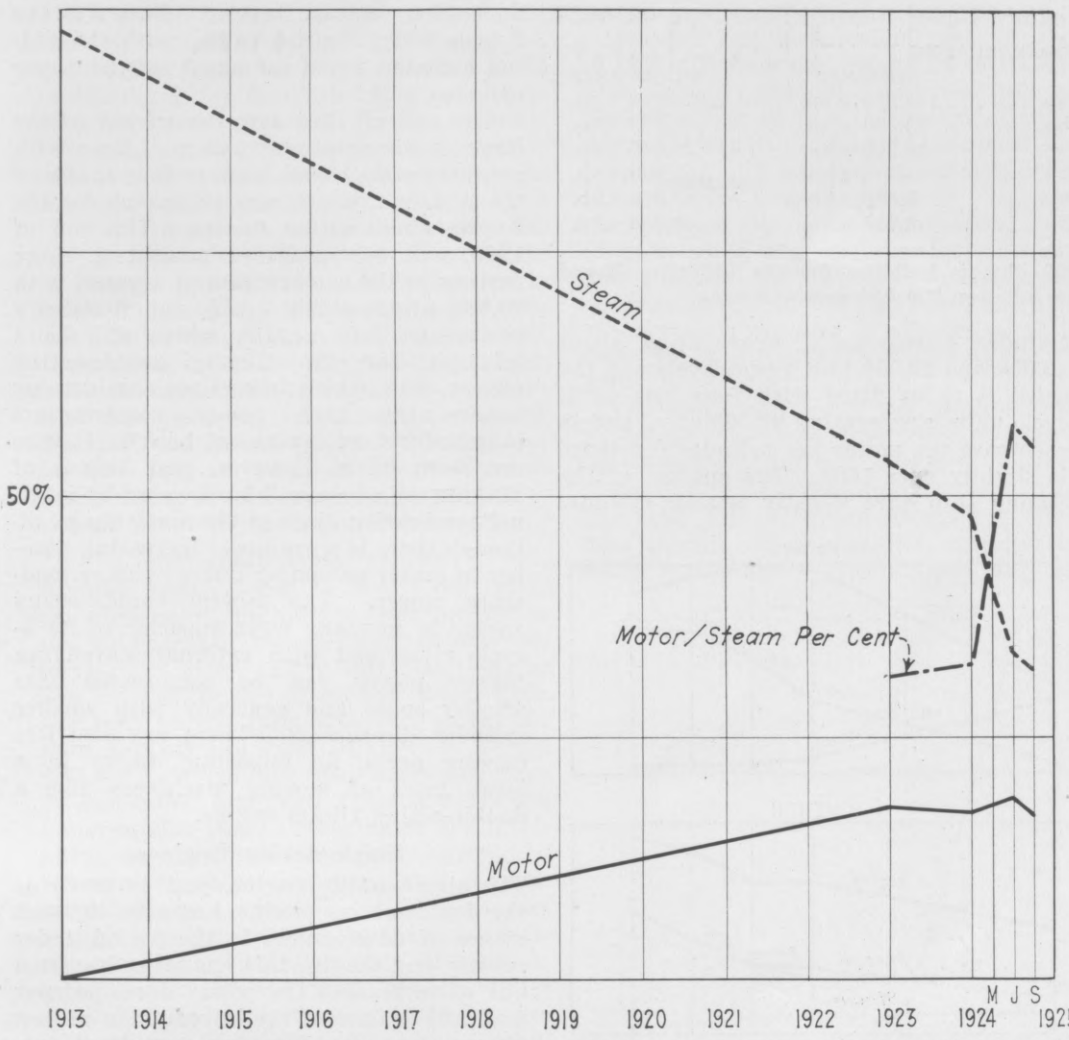

Fig. 2. Motorships and steamers under construction in the United Kingdom from 1913 to 1925

Table 1—Motorships and Steamships Under Construction in the World

QUARTER ENDED	STEAMERS	MOTORSHIPS	MOTOR/STEAM
Dec. 31, 1913	1,353,098 tons	None recorded	—
Dec. 31, 1923	1,793,579 "	634,027 tons	35 per cent
Dec. 31, 1924	1,530,885 "	923,738 "	60 " "
March 31, 1925	1,357,834 "	1,021,631 "	75 " "
June 30, 1925	1,212,525 "	1,129,912 "	93 " "
Sept. 30, 1925	1,090,456 "	1,088,888 "	99.8 " "

Table 2—Motorships and Steamships Under Construction in Great Britain and Ireland

QUARTER ENDED	STEAMERS	MOTORSHIPS	MOTOR/STEAM
Dec. 31, 1913	1,952,814 tons	None recorded	—
Dec. 31, 1923	1,065,770 "	323,641 tons	30.3 per cent
Dec. 31, 1924	976,134 "	320,137 "	32.8 " "
March 31, 1925	800,848 "	359,920 "	45 " "
June 30, 1925	687,607 "	399,070 "	58 " "
Sept. 30, 1925	646,410 "	356,480 "	55 " "

Table 3—Motorships and Steamships Under Construction in Selected Countries

QUARTER ENDING	COUNTRY	STEAMERS	MOTORSHIPS	MOTOR/STEAM
	Denmark	28,109 tons	34,087 tons	121 per cent
Dec. 31, 1923	Sweden	7,584 "	35,300 "	464 " "
	Germany*	187,823* "	135,561 "	72 " "
	Denmark	9,428 tons	75,400 tons	800 per cent
Dec. 31, 1924	Sweden	7,180 "	50,400 "	700 " "
	Germany	78,539 "	274,071 "	350 " "
	Denmark	6,210 tons	77,084 tons	1,200 per cent
March 31, 1925	Sweden	7,180 "	50,400 "	700 " "
	Germany	80,321 "	324,155 "	403 " "
	Denmark	4,250 tons	73,511 tons	1,730 per cent
June 30, 1925	Sweden	5,730 "	61,100 "	1,066 " "
	Germany	92,217 "	313,309 "	342 " "
	Denmark	3,900 tons	66,860 tons	1,710 per cent
Sept. 30, 1925	Sweden	5,130 "	66,450 "	1,300 " "
	Germany	88,951 "	217,675 "	245 " "

Table 4—Motorships and Steamship Tonnage Under Construction in Italy

QUARTER ENDED	STEAMERS	MOTORSHIPS	MOTOR/STEAM
Dec. 31, 1923	105,077 tons	13,000 tons	12.3 per cent
Dec. 31, 1924	90,290 "	60,800 "	67.3 " "
March 31, 1925	77,486 "	84,137 "	108.0 " "
June 30th, 1925	76,593 "	134,255 "	175.0 " "
Sept. 30, 1925	75,894 "	192,512 "	253.0 " "

world, the German shipyards are not operating at anything like their pre-war output and the present total (steam and motor) output, 306,626 tons gross, is some 245,000 tons short of the output for the last quarter of 1913. When the history of the motorship is written, Germany will always be cited as the champion of indirect or transmitted drive and more particularly in its hydro-mechanical interpretation. The present year has seen two ships go on service in which single screws are driven by two sets of 4-cycle high-speed crosshead engines through the medium of single mechanical reduction gearing and Vulcan hydro-mechanical clutches.

The Italian Shipbuilding Boom

Italy presents rather an interesting case as regards increase of motorship construction, as Table 4 and Fig. 4 show. In one year—from December 31, 1923, to December 31, 1924—the tonnage under construction in Italian shipyards to be fitted with internal combustion engines increased from 13,000 to nearly 61,000 gross tons with a corresponding decrease in steamship construction of 14,787 tons, the percentage of motor to steam tonnage in this period increasing from 12.3 to 67.3.

The last year, however, has witnessed an almost unprecedented boom in Italian shipbuilding generally, and although in the three-quarters of the elapsed year under review, the steamer tonnage has decreased from 90,290 tons at December 31, 1924, to 75,894 at September 30th of last year, the motorship tonnage under construction in this period has increased from 60,800 gross tons to 192,512 gross tons. In other words, whereas in December, 1924, Italian motorships in course of construction represented just over 67 per cent of the steamships, at the end of the last quarter, they amounted to over two and a half times the steamship tonnage. This tremendous increase, and indeed the boom in Italian shipbuilding generally, is due largely to the fact that Italian shipbuilders are being assisted financially by the Government, and also much of the tonnage and some of the engines are being built under the terms of the Reparations Agreement.

Large Passenger and Mail Liners

All categories of merchant ships are represented in the above Italian motorship figures, but foremost among them is a ship of whose construction Italian marine engineers and naval architects must be justly proud, and that is the passenger and mail liner AUGUSTA of 33,000 tons gross, particulars of which will be found in Table 6. This vessel, which is intended for transatlantic service, was ordered during the present year from the Ansaldo Co. by the Navigazione Generale Italiana, and she is, at the time of writing, the most powerful motorship ordered in the world, exceeding in power the Royal Mail Steam Packet ASTURIAS by some 8000 hp. She is specially interesting in that she will be propelled by 2-cycle double-acting engines of German (M.A.N.) make, driving four screws, each engine having six cylinders of 700 mm. diameter by 1200 mm. stroke. The 4-cycle engines of the ASTURIAS, now practically completed, have each eight cylinders 840 mm. in diameter by 1500 mm. stroke. In the ASTURIAS a maximum of 10,000 i.hp. per shaft is developed with eight cylinders

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Table 5—Steam and Internal Combustion Engines Under Construction, Sept. 30, 1925

COUNTRY	STEAM ENGINES		OIL ENGINES
	RECIP.	TURBINES	
Great Britain	282,361 i.hp.	143,359 s.hp.	216,510 i.hp.
Germany	28,610 i.hp.	23,300 s.hp.	131,770 i.hp.
U. S. A.	8,100 i.hp.	35,200 s.hp.	21,545 i.hp.*
Denmark	3,300 i.hp.	— s.hp.	102,900 i.hp.
Sweden	3,300 i.hp.	2,550 s.hp.	63,070 i.hp.
Holland	38,610 i.hp.	3,000 s.hp.	49,930 i.hp.

* This figure is obviously wrong, because 50,000 i.hp. is building for the Shipping Board alone, and the total is about 100,000 i.hp. in engines of over 300 hp. each.—EDITOR.

on each of two shafts and in the AUGUSTA about 7000 s.hp. on each of four shafts with six cylinders.

The present Italian motorship construction programme includes various types, as has been indicated, but mention should specially be made of the fact that certain companies, such as the Cosulich Line of Trieste, have put in hand the experiment of what I may call selective powering, or the fitting of two different makes of engine —one 2-cycle and the other 4-cycle—into two ships of exactly the same hull form and dimensions. This experiment, which incidentally has been carried out by a Dutch firm—the Royal Packet Navigation Company of Amsterdam and by a Japanese firm, should enable shipowners to obtain first hand an appreciation of the relative merits of the two rival working cycles.

High Power Installations and Double-Acting Engines

The foregoing has dealt with progress generally in terms of satistics. It is now of interest to cover briefly some of the more detailed matters of interest, and Table 6 should be studied in this connection, since it shows noteworthy motorships of different categories added to the world's mercantile fleets during the period under review. As far as passenger liners are concerned, one noteworthy vessel has been completed for service, the 17,000 ton gross GRIPSHOLM, constructed for the Swedish-America Line.

One important vessel was launched and is now rapidly nearly completion—the 22,-000 ton gross ASTURIAS, constructed by Harland and Wolff, Ltd., for the Royal Mail Steam Packet Co.; and the largest motor passenger liner in the world has been laid down—the 33,000 ton gross AUGUSTA, an Italian vessel, to which reference has been made already.

These three ships all represent a triumph for the double-acting internal combustion engine, a type of prime mover about which so many doubts were expressed initially. The first two are propelled by two 6 and 8-cylinder 4-cycle units, aggregating about 16,000 and 20,000 i.hp. respectively and the third is to be fitted with four sets of 2-cycle units aggregating 28,000 s.hp., and in each case the power per cylinder developed is slightly over 1000. The engines of the Italian ship have slightly smaller cylinder

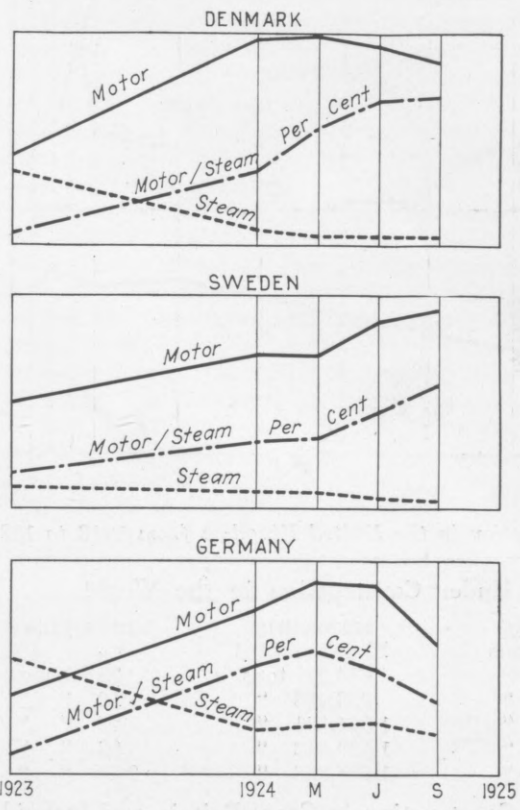

Fig. 3. Comparative shipbuilding in selected countries

dimensions than those of the 4-cycle units, but the rates of revolution are about the same. This represents a notable advance, when it is considered it was only in 1922 that the first practical sea-going double-acting marine internal combustion engine ran test bed trials, and only last year that the first mercantile vessel propelled by such an engine went on service. This was the 2-cycle North British engine with the sliding cylinder, rated for about 660 b.hp. per cylinder unit.

The end of 1924 saw the advent of the large motor passenger and mail liner with approximately 16,000 b.hp. in four shafts of the AORANGI, which was a triumph for the 2-cycle single-acting engine. The end of 1925 will see progress pushed a stage further in the construction of a vessel with 28,000 s.hp.—nearly double the AORANGI'S power—on four shafts, which will be a triumph for the 2-cycle double-acting engine, and which brings us considerably nearer the high power requirements sketched out in my recent book*. It does not seem likely, however, that vessels of MAURETANIA type will be powered by internal combustion engines for many years, although there is a gradually increasing number of motor passenger liners of more moderate power. The 2-cycle double-acting engine is in many ways superior to its 4-cycle rival, and with external scavenging higher power can be compressed into smaller space and generally with smaller cylinder dimensions. There are also less moving parts, an important factor in a large mass of moving machinery like a double-acting Diesel engine.

Single-Acting Engines

The single-acting engine, just as much as the double-acting engine, has gone through stages of development in the period under review, and the line this has taken has been one of increasing the power developed per unit rather than of the introduction of new types. A study of engines completed during the year shows that there is a general tendency towards simplicity of construction and standardization, so that there may be a ready interchange, not only of parts, but also of personnel. It is only by such means that a Diesel-engined fleet can be maintained in a state of high efficiency, and the engine for cargo vessels of the future will undoubtedly be a slow-running lightweight engine standardized down to the last bolt and nut.

Last year the Werkspoor Co., it will be recalled, re-arranged its engine's exhaust manifold, altered the framing of the engine and re-arranged the cylinder castings. This year the North Eastern Marine Engineering Co. has finished its first engine of this type, an 8-cylinder unit developing 3000 i.hp. at 92 r.p.m. fitted in the 8000 tons d.w.c. vessel RABY CASTLE. This 4-cycle en-

*"Motorships," by A. C. Hardy, B.Sc.

Table 6. Power Details of Typical Motorships of 1925

NAME	TYPE	TONNAGE	NATIONALITY	POWER	TYPE OF ENGINE
AUGUSTA	Passenger liner	33,000 gross	Italian	28,000 s.hp.	4 sets 2-cycle M. A. N. double acting engines. 700mm.x1200mm.
ASTURIAS	Passenger liner	22,000 gross	British	20,000 i.hp.	2 sets 4-cycle H. & W.—B. & W. double-acting engines, 840mm.x1500mm.
SVEALAND	Ore carrier	20,600 d.w.c.	Swedish	6,400 i.hp.	2 sets 4-cycle A. E. G.—B. & W. single-acting engines, 740mm.x1200mm.
PORT HOBART	Refrigerated ship	10,800 d.w.c.	British	6,000 i.hp.	2 sets 2-cycle Doxford opposed piston engines, 540mm.x1080mm.
J. W. VAN DYKE	Oil tanker	7,500 d.w.c.	American	2,300 s.hp.	d.c. motor taking current from two 600 kw. generators driven by Ingersoll-Rand engines, 19½ in. x 24 in.
DUISBURG	Cargo vessel	9,500 d.w.c.	German	4,100 s.hp.	2 sets 4-cycle M. A. N. single-acting, driving through Vulcan hydro-mechanical clutch, 640 mm.x700mm.
RABY CASTLE	Cargo carrier	8,000 d.w.c.	British	3,000 i.hp.	1 set 4-cycle North Eastern Werkspoor single-acting engine, 730mm.x1300mm.

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gine it is extremely interesting to compare with two sets of A. E. G.—B. & W. 4-cycle engines, completed for a 20,600 ton d.w.c. ore carrier (one of two vessels) built in Hamburg for Swedish owners for ore-carrying from Chile to North America. This ship is one of the largest motor cargo vessels in the world and each of the main engines is an 8-cylinder unit rated for 3200 i.hp. at 110 r.p.m. As Table 6 shows, the cylinder diameter of the Burmeister engine is 10 mm. greater than that of the Werkspoor engine, while the stroke is 100 mm. less. These two engines, and a 2-cycle unit constructed by Sulzer Bros., for the BINTANG an ex-steamer owned by the Netherland Steamship Co., of six cylinders (cyl. dia. 760 mm. by 1340 mm. stroke) rated for 3600 b.hp. at 90 r.p.m. are the largest single-acting Diesel engines in existence, and are all products of this year's work.

Refrigerated Motorships

Another type of ship to which the internal combustion engine has been applied is the refrigerated vessel designed for the carriage of meat, and in this direction the Commonwealth and Dominion Line, Ltd., has been to the fore with two ships, the PORT HOBART and PORT DUNEDIN of 10,800 tons d.w.c., which took their maiden sailings to Australian and New Zealand ports via Panama, this year. These ships are interesting as the first-twin-screw opposed-piston engined ships, and they have also an extraordinary complete equipment of electric auxiliary machinery, the refrigerating machines, themselves two in number, being driven by 110 b.hp. motors, direct coupled. The main engines themselves are four-cylinder Doxford units, having cylinders 540 mm. diameter with a piston stroke of 1,080 mm. Scavenging is carried out on each engine by a crank on the main crankshaft between each pair of cylinders.

These two ships can be bracketed with two other refrigerator motor ships of somewhat larger size, fitted with 2-cycle machinery of Sulzer type built by John Brown and Co., Clydebank (hull by W. Hamilton and Co., Port Glasgow), and the Fairfield Shipbuilding and Engineering Co., Ltd., for the Union Steamship Company of New Zealand, Ltd., and the Houlder Lines Argentine Service, respectively. The former—the LIMERICK—has a deadweight capacity of 11,450 tons and two 6-cylinder engines (680 mm. cyl. dia. by 1200 mm. stroke) designed for 3000 b.hp. per engine at 100 r.p.m. The latter—the UPWEY GRANGE—has a refrigerated capacity of 500,000 cub. ft. and two 6-cylinder engines of approximately the same size and power as those constructed for the LIMERICK.

Indirect Drive

The only refrigerated motor ships constructed in this country prior to the two mentioned above were two vessels, of an original three, completed last year by Cammell-Laird and Co., for the United Fruit Co., of Boston. These ships had electric drive, current being supplied from generators driven by Cammellaird-Fullagar opposed piston engines. Two of these were completed as designed, but the third had her original machinery taken out and steam reciprocating engines and boilers substituted. These ships represent nevertheless the only examples of the Diesel electric drive for sea-going ships constructed in this country, and the present year has been quite blank, as far as Great Britain is concerned in this system of propulsion.

America has made considerable progress in this direction and sea-going oil tankers (see Table 7) side wheel ferries, tugs and dredgers may all be cited as ship types in which internal combustion engines have been fitted, driving generating sets which in turn drive propelling motors. Germany on the other hand, has favored the fitting of high speed engines in pairs, driving a single screw through the Vulcan hydro-mechanical clutch, and two 9000 tons d.w.c. cargo vessels are now in regular operation (see Table 6) employing this system of drive.

The characteristics of this form of drive have been discussed from time to time in considerable detail and it is not necessary to go over these points again, except to say that the Vulcan hydro-mechanical clutch does permit of an ease of maneuvering which is not easily approachable with any other form of internal combustion drive. In all probability it is more costly both initially and in fuel, but the performance of the two German ships now on service will prove this, and it will be interesting to see whether any further orders of a similar nature are placed. The British shipowner does not seem to regard indirect schemes with any measure of favor.

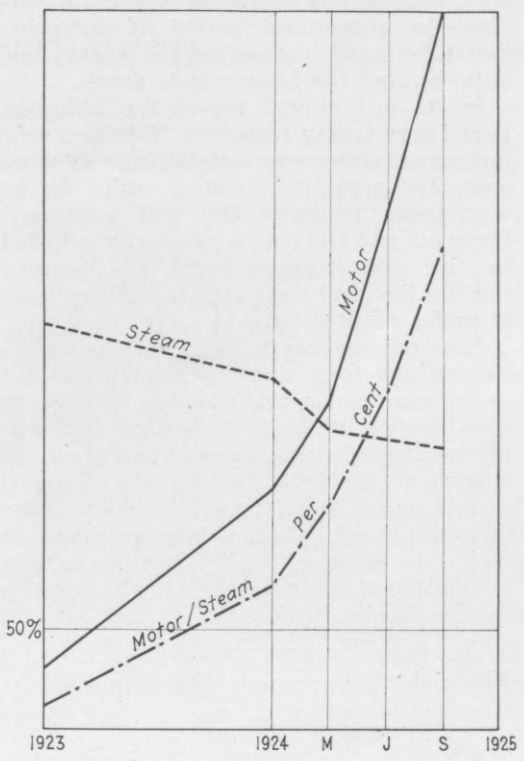

Fig. 4. Comparative shipbuilding in Italy

A New Cast Iron

It has often been suggested that one of the limiting factors in Diesel engine progress is the question of metallurgy and the production of castings which will successfully stand up to the heat and other stresses to which they are subjected, and from this point of view, one of the most important developments of this year is the introduction into Great Britain of a process for the manufacture of cast iron which has been in use for some time on the Continent. The patent rights have been acquired by the British Perlit Iron Co., London, and a prominent Diesel engine building concern as well as a well-known shipowning firm interested in Diesel engine progress, are represented on the board of directors. The Perlit process of manufacture, in brief, aims at homogeneity of structure in the casting, and the production of a cast iron with the characteristics of steel, uniform composition throughout, irrespective of section and shape. An ordinary casting of varying section, on cooling, changes in composition, density and strength at various parts, being pearlitic in one part while in the other it may be ferritic or cementitic. The Perlit system claims to make the most complicated casting wholly pearlitic and homogeneous, and of uniform strength. It will be interesting to note to what extent the process is adopted in this country.

Conclusion

The foregoing remarks have sketched, in brief, the present position of the motorship. The year just passed has been characterized by steady development and by a steady general increase in the number of motorships laid down. Two prominent shipowners, Lord Kylsant and Lord Inverforth, have publicly, and in no half-hearted manner, declared their confidence in and satisfaction with the running of motorship fleets, which they evidently regard as the fleets of the future. Pessimists say that the widespread adoption of the motorship will spell even greater ruin to our coal industry, while optimists maintain that it will end in giving us a period of greater general prosperity. In the meanwhile, those of us who are enthusiastic about the Diesel engine can look forward to another year which will certainly not be blank as far as development is concerned.

In order to secure more spacious accommodation in the passenger staterooms and thereby provide greater comfort, the new ocean cruising passenger motorship to be built by the Götaverken for Det Bergenske Dampskibsselskab will be designed to carry only 200 passengers and not 300 passengers as stated in the first announcement about this vessel on page 749 of the October issue of MOTORSHIP. In arriving at this decision one of the factors which the owners kept in view was the desirability of limiting the size of the shore parties which on many of the cruisers offered to the public tend to be unduly crowded. The new vessel of Det Bergenske Dampskibsselskab will be devoted to cruises in which the comfort of passengers will be more carefully studied than is now the general custom.

For the Union Steamship Co. of New Zealand a twin-screw tanker OTOKIA was recently completed in England. She is a vessel of 10,350 tons d.w. measuring 437 ft. 9 in. b.p., 57 ft. molded breadth, 33 ft. 9 in. molded depth to the upper deck and of 7277 tons gross, with two four-cylinder Sulzer engines of 1500 b.hp. each at 110 r.p.m. She has a speed of 12 knots. Scavenging air for these engines is provided by two Brown Boveri steam turbine driven blowers working at 3100 r.p.m. Only one blower is necessary for both engines, but a second blower is fitted as a standby. Large suction chambers for the scavenging air intake are built under the main deck, connecting with the atmosphere through a trunk and capable also of drawing from the engine-room. Most of the auxiliaries are steam driven.

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Merchant Marine Future Is Up to Congress

ABANDONMENT of private operation of the American Palmetto Line which the Carolina S. S. Co. bought from the Shipping Board so recently as last September illustrates the inherent weakness of the expedient to which the Board has been forced by the insistent demand that it get rid of ships at any price.

Sales of Government established Lines to private operators at low prices with a guarantee of five years' maintenance of the service are characterized by the Shipping Board itself as the utilization of ships instead of money to pay operators for their operating losses. It is a subsidy in kind instead of in cash.

In the case of the American Palmetto Line the subsidy in kind was not big enough to assist the Carolina S. S. Co. in meeting the losses, and the Board had no option about retaking possession of the ships involved. It has decided very properly to continue the service and meet the losses with money out of its annual appropriation, as it is doing with all its other Lines.

How far the Board shall maintain the merchant marine we have for the carriage of part of our foreign trade is for Congress to determine. Whether the lines already established are to be gradually abandoned is for Congress to rule. Congress is the arbiter because it votes the appropriations, which are either sufficient or insufficient. The Shipping Board is only its agent.

Year by year the appropriations have been reduced. For the fiscal year 1924 a sum of $50,000,000 was voted; for 1925 a cut was made to $30,000,000; to cover the year ending June 30 next only $24,000,000 was provided; and for the fiscal year 1926-1927 Congress has been told by the Bureau of the Budget to reduce the amount to $14,000,000.

Obviously the operation of vessels must follow the same descending scale. In the fiscal year 1923-1924 the Board had an average of 338 vessels in operation; during 1924-1925 the average was 299; in the fiscal year now current an effort is being made to hold an average of 279 in operation, and this figure will be cut down nearly to 150 ships next year if Congress accepts the dictation of the director of the budget.

Are administrative Washington and Congress too blind to see that two more such steps in this direction will be the doom of the American merchant marine in foreign trade? Without any appropriation for vessel operation the Shipping Board could do no more than sell such Lines as private operators might be persuaded to buy at any price down to $1 per ton with guaranteed service of perhaps as short as one year. The end would be gradual but sure, because the operators who could survive the guaranteed period of operation certainly could not afford to order new tonnage, and the Lines would decay.

In its last annual report the Shipping Board very tritely remarks: "Devising new instrumentalities, or modifying existing ones, for operating existing ships in no way tends to solve the real question." Congress and the nation are perhaps fooled by the sales already made of Shipping Board Lines, but the Board itself is certainly under no delusions.

If Congress does not sustain the operation of the Government owned ships and order new and more efficient tonnage to keep the fleet up to date until such time as the trend of national feeling shall favor the enactment of legislation for the financial assistance of American private shipowners in foreign trade, there will be no chance to "solve the real question." The real question is what form the assistance to the ships in foreign trade shall take.

British Government Guarantees for Modern Ships.

BRITISH GOVERNMENT credit last month assisted the Silver Line to finance the construction of six large, fast motorfreighters. Piquancy is added to the transaction by the fact that these ships, which will operate between New York and the Far East, will outspeed the new motorvessels which the Rio Cape Line ordered in Germany for the same service. The present motorships of the Silver Line are 11 knot boats. Furness Withy & Co. ordered 14-knot vessels for the Rio Cape Line. The Silver Line's reply is in the six new 14½ knot vessels.

There are, of course, no vessels in the Shipping Board fleet capable of matching these new British motorvessels, and no private operator could dream of offering competition against them under the American flag. That the business is lucrative can be judged from the class of ship which the British are building for it. It offers prospects of considerable expansion, for our trade with the Orient is expected to show an expansion greater than with any other part of the world. The more is the pity that Congress will not heed the need for construction of vessels fit to meet modern competition.

These 14½ knot motor freighters exemplify very clearly how far the technics of ocean transportation have advanced since our emergency fleet was built, the fleet with which our carrying business is done today. It is instructive also to note what these modern freighters cost. The new Silver Line vessels were contracted for at about $175 per gross ton or about $100 per deadweight ton. For the existing Silver Line boats the newly incorporated Silver Line, Ltd. paid about $115 per gross ton or about $70 per deadweight ton. These figures form a striking contrast with prevailing prices on new or used steam tonnage. When the British Government guarantees the bonds of a shipping company that pays prices like these it demonstrates that it has not lost its nerve like Congress has.

Developments in 4-Cycle Engine Design

SEVERAL innovations lately reported in 4-cycle engine practice have demonstrated that the design of the type of oil engine which practically monopolized all the early motorship work cannot yet be regarded as having reached a permanent form. The 4-cycle engine was the first to win favor because the problems of its design, being simpler, were more easily overcome. The 2-cycle engine has always presented the attractive advantages which are urged for it today, but the greater intricacy of its problems baffled the engineers for many years. Only the stout-hearted courage of two or three leading builders kept it alive and provided the opportunity for its problems to be worked out.

Through the concentration of so many minds on the study of the 4-cycle engine this type evolved very rapidly until the advent of the European war caused a cessation of all engineering developments along such lines. The subsequent stagnation of design gave currency to the belief that the 4-cycle engine had attained practically a standard form.

One of the most notable developments since the war has been the adoption of supercharging as standard practice by at least one German firm and its occasional use by other leading firms. Quite recently another striking development has been made by an American firm, which has patented a system of direct reversing for application to 4-cylinder engines of the 4-cycle type. Both in Russia and in Holland this idea was introduced 15 years or more ago, but the mechanism then employed was evidently not entirely satisfactory for one reason and another, and nothing further was done along that line.

There have been recent notable changes in design, sponsored by one of the oldest and biggest builders in Europe. They have introduced, for instance, a chain drive for the camshaft in place of the more usual gearing. This is being applied now to the biggest double-acting engines as well as to trunk piston engines of far smaller sizes. The reversal of all previous practice presented by the location of the flywheel at the forward end of the engine and of the compressor at the after end is also worthy of note. The flywheel has possibly been placed forward with the camshaft chain drive adjoining in order to get the steadiest possible drive on the chain. Such departures from previous practice deserve attention. Their adoption by leading designers shows that the evolution of the 4-cycle engine is not yet completed.

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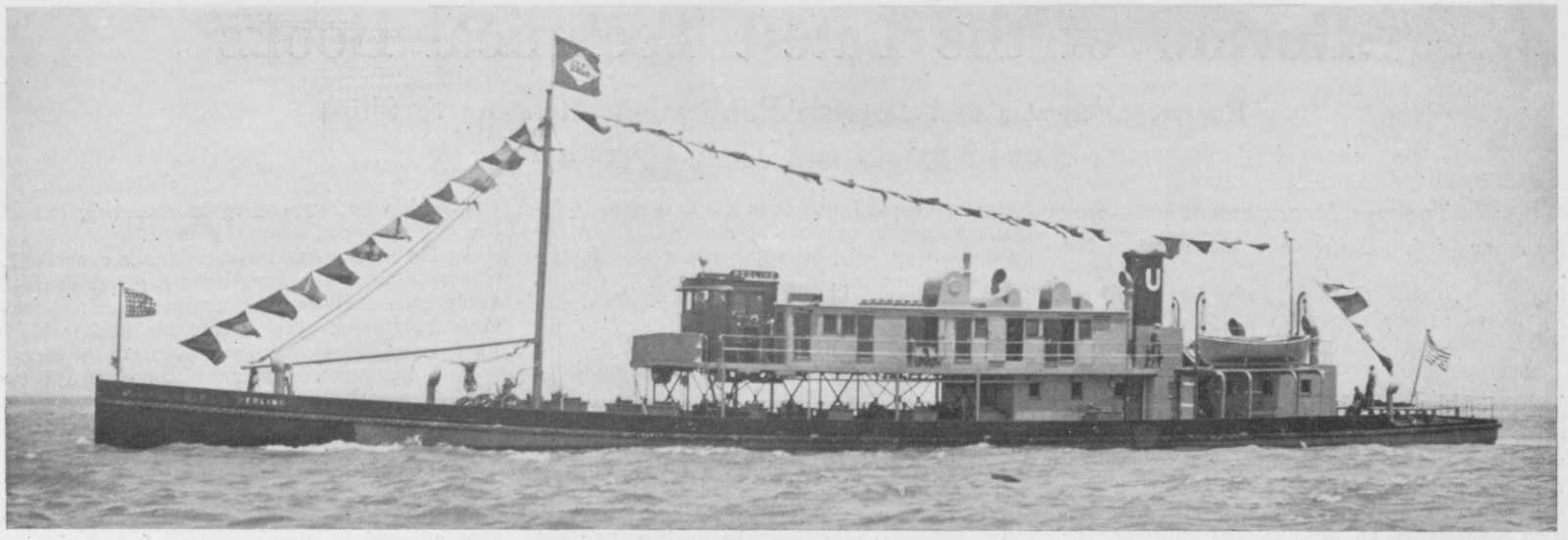


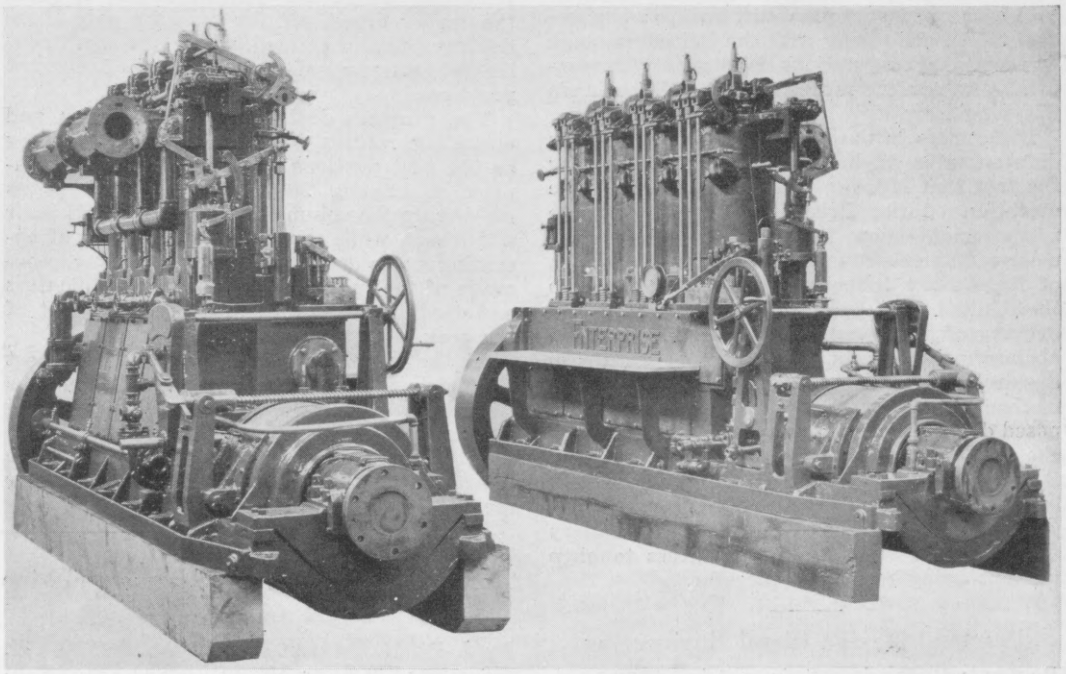
Union Oil Company's longitudinally framed shallow draft twin screw tank barge Redline used for bulk distribution in San Francisco Bay

Motor Tankers on San Francisco Bay

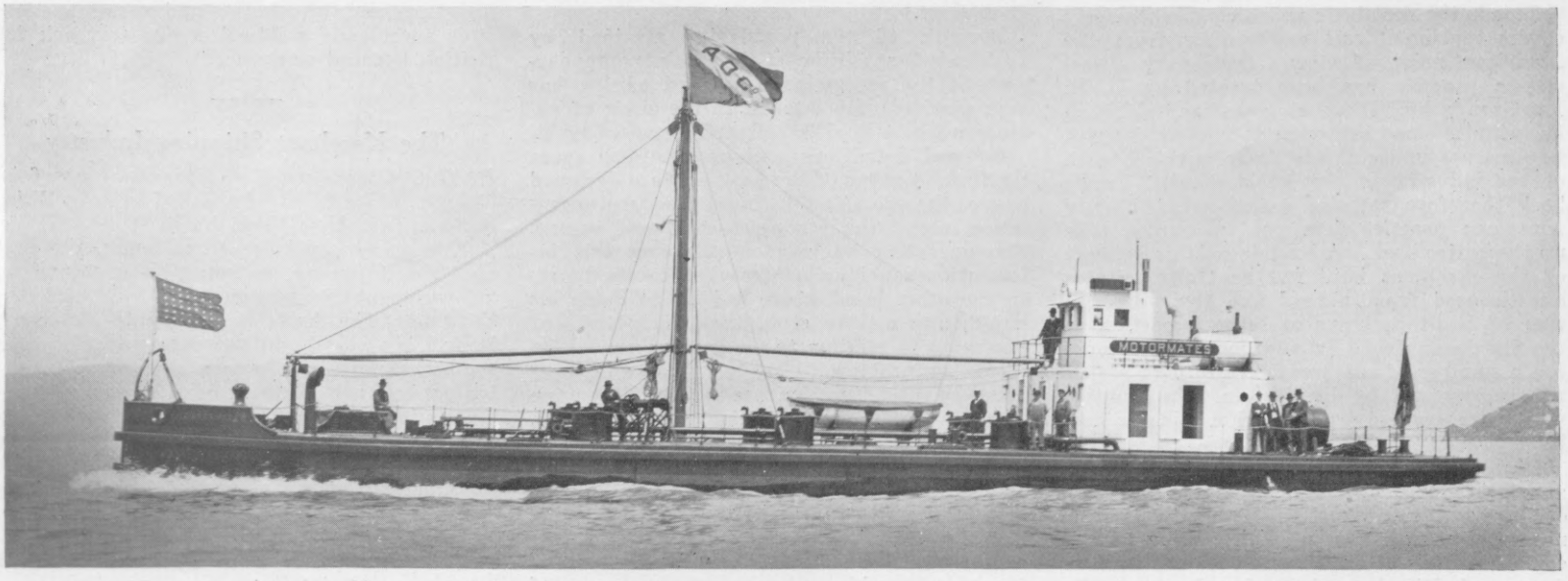
REDLINE is the name of a shallow draft twin-screw motor tanker which the Union Oil Company placed in service last summer for carrying refined oil in bulk around San Francisco Bay. She is a vessel of 400 gross tons, with a capacity of about 150,000 gal. in her tanks in addition to 15 tons of package goods in the fore hold. Cofferdams separate the oil cargo from the fore hold and from the engineroom.

The vessel, which is built on the Isherwood system, with a straight stem and transom stern, is 175 ft. long overall, with 36 ft. molded beam and 7 ft. molded depth. For propulsion there are two Western Diesel engines, with four cylinders of 10½ in. diameter and 15 in. stroke, developing 165 b.hp. at 280 r.p.m., each coupled with a reversing clutch. There is also a small lighting set in the engineroom and the usual auxiliaries, the machinery all being located aft with the pump room on the upper deck at the after end of the oil space. Sufficient fuel is carried for about 135 hours continuous running and is stored in the wings of the space just abaft the engineroom. Accommodation for officers and crew is provided in a steel deckhouse on the bridge deck.

MOTORMATES belongs to the Associated Oil Company and has also been placed in service recently. She was built by the Hanlon Drydock & Shipbuilding Co. and carries 400 tons of oil cargo. Her registered dimensions are 114.3 ft. x 32.1 ft. x 8.3 ft. and she is powered with two 80 hp. Atlas-Imperial engines.



Twin Diesel engines of 165 s.hp. each used for propulsion in the Redline



Associated Oil Co.'s Diesel engined tank barge of 400 tons cargo capacity recently commissioned for service in San Francisco Bay

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Review of the Latest Technical Books

Recent Domestic and Foreign Publications Relating to Ships and Engines and Their Operation

Tonnage Measurement

By A. van Driel, Chief Naval Architect of the Shipping Inspection Service at The Hague. 9½ in. x 6 in. 158 pp. Price 3½ guilders. Published at the Government Printing Office, The Hague, Holland.

This historical and critical essay, published in English by the Dutch Government, is a welcome addition to the restricted library of books on the subject of tonnage measurement. Mr. van Driel's experience as a naval constructor in Holland and as lecturer on naval architecture at Delft University, combined with his later experience as head of the shipping inspection service at The Hague, have qualified him to analyze the problems from the aspects of cargo capacity and seaworthiness as well as fairness.

He shows that the tonnage measurement basis always has had an influence on the seaworthiness of vessels. History records tonnage measurement rules which so far encouraged unseaworthy types of vessels that the rules had to be changed for that reason alone. Even today, the author points out, an open shelter-deck vessel complying with the British tonnage measurement regulations is distinctly unseaworthy within the meaning of the Netherlands Shipping Law.

Differences in national viewpoint as well as differences in training account no doubt for the fact that Mr. van Driel's treatment of the evolution of the British system of tonnage measurement—now the basis of the rules of most countries—is somewhat different to that of Dr. Emory Johnson in the report made to the United States Government prior to the opening of the Panama Canal. Mr. van Driel examines the defects of the present system in a searching manner and analyzes the different methods of measurement that have been proposed during the last few years. In a separate chapter he outlines his own preferences and the reasons therefor. As might be surmised, his proposals would remove the anomaly that prevents motorships reducing their machinery space below 13 per cent of the gross tonnage without being penalized therefor.

Practical Marine Diesel Engineering

By Louis R. Ford. 8¾ in. x 6 in. 512 pages. Price $7.50 plus postage. Published by the Simmons Boardman Publishing Company.

This is the first book which comprehensively covers marine Diesel engineering from the American point of view. Stationary Diesel engine practice has been treated by L. H. Morrison in his "Diesel Engines" and although he includes some reference to marine designs, he does not undertake to describe this branch of the industry in any great detail. Ford's book therefore satisfies a real need. Purely American practice does not, of course, take up the entire book. A considerable percentage of the machines built in the United States are licensed from abroad and their description of itself portrays at least a portion of the European field. In addition thereto there are a number of representative foreign makes not represented by licenses in this country, which are covered by L. R. Ford in his new book.

Disclaiming any attempt to cover the wide and ever-changing ramifications of present-day design in an exhaustive way, the author nevertheless succeeds in bringing together a copious supply of information on the various forms of Diesel engines found along the American coast line. It is the first book to include a certain amount of material about the double-acting engine, but specific double-acting questions such as stuffing-box design, allowing for two-way cylinder expansion, piston-rod fastenings and the like are to all intents and purposes neglected.

The chapter entitled "Diesel Engines of Medium and Small Sizes" forms an ingenious classification and includes a number of near-Diesel types such as those designs which are built under Leissner and Hvid licenses. Surface-ignition machines are not touched upon.

Addressing himself primarily to the practical operating engineer, the author does not illuminate the reader's understanding of the engine structures with references to the design, manufacturing, and operating conditions which are fundamentally responsible for their form. What the engineer gets out of the book must therefore be taken up by a sheer act of memory, supported almost wholly by such a knowledge of whys and wherefores as he may already possess. As the book does very little reasoning about the designs found, it gives the reader direct aid for knowing only those designs actually treated, which are admittedly limited samples of the totality of current practice.

The chapters dealing with installation and operating routine will be regarded by many as the best portions of the book. They comprise practically 200 out of the 500 pages making up the volume. The reasoning is clear and direct, while the very large number of operating items dealt with gives a thorough coverage of the subject. The chapter on indicators and cards is below the standard of the rest of the book.

At the very end is included the usual set of questions and answers, along with another feature which should appeal to operators and prospective marine Diesel engines. This is a chapter which fully explains the rules of the Board of Supervising Inspectors governing the issuance of licenses.

"Verbal" Notes and Sketches on Marine Diesel Oil Engines

By J. W. M. Sothern, M.I.E.S., M.I.Mar.E. 766 pages. 9 in. x 5¾ in. Price $15. Published by Crosby Lockwood & Son, London, and obtainable through Motorship Technical Book Dept.

Because of the popularity attained by Sothern's first edition of this book the appearance of the second and enlarged edition has been awaited with interest in the circle of engineers whose field is primarily covered by it.

General definitions and explanations cover the first 58 pages of the book and are designed to give the operating engineer a general orientation about the air-injection Diesel engine. The operating engineer memorizing this information could undoubtedly make use of it; on the other hand, there is little to guide his intelligence and to strengthen his powers of reasoning in relation to the general run of his operating practice.

In the second section are treated 10 engine types of which one is Danish, another Dutch, a third Swiss, and the remainder British. Of each engine type there is a description, in which little attempt is made to explain the reasons for the structural elements treated. The addition of an operator's manual to each of the engine descriptions would have been of direct and specific assistance to a possessor of this book who happens to be operating one of the engine types occurring in it.

As far as the American reader is concerned, this section of the book loses a great deal of value because it entirely omits American machinery, failing even to include such widely used types as those manufactured by McIntosh & Seymour, Fairbanks-Morse, and Winton. The omission of all reference to German and Italian types further restricts the general interest of the book.

The fact that the book is larger than usual and well illustrated makes a somewhat encyclopedic impression, which is at first strengthened by the inclusion of such details as electric steering gear and surface ignition engines. Upon close examination, however, it almost appears as though these are merely random details which do not begin to give a general coverage of the branches to which they belong. It is still more difficult to explain the inclusion of a considerable amount of gasoline and kerosene engine material which can no more escape the imputation of being fragmentary than the references to electrical apparatus and engines of a type not altogether germane to the leading subject of the book.

The indicator section of the volume contains a large number of examples explained with elementary detail, while the methods of calculating indicated power are explained from the point of view of the operator possessing a beginner's knowledge. The reproduction of the cards leaves something to be desired, and their selection makes it questionable whether the author has that fine sense of indicating technique which this delicate measuring operation is ordinarily considered to require.

The question and answer section of the book is extensive and to a certain extent replaces the method of indexing practiced in standard engineering handbooks. The question side of the column quickly allows the reader to select and concentrate on the particular subject about which he wishes information, while the answer placed directly next to it saves the time and effort required for the manipulation of an ordinary index.

In view of these observations on "Notes and Sketches" it is difficult to classify the book either as an encyclopedic work such as its imposing size would suggest or as an operator's manual such as it might have been made by the inclusion of manufacturers' operating directions and the question and answer section. It is specifically a Diesel engine textbook for British licensed engineers.

The Merchant Shipping Industry

By H. C. Calvin and E. G. Stuart. 9 in. x 6 in. 374 pp. Price $4.00. Published by John Wiley & Sons, Inc., New York, N. Y.

This volume includes three books, the first on "The Shipping Industry," the second on "Government Regulation and Aid" and the third on "The American Shipping Problem." Book I is virtually an elementary text-book on the economics and practices of shipping, written not so much for the guidance of young men starting in the shipping business as for paving the way to an acceptance of the authors' views of the futility of endeavoring now to establish an American merchant marine for our foreign trade. Book II deals with the various ways in which governments can give support to shipping, and reviews the aid given by the chief

(*Continued on page* 50)

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Recent Technical Reports and Addresses

A Review of the Principal Monographs on Motorships, Marine Oil Engines and Associated Subjects

The Double-Acting Two-Cycle Oil Engine

By O. E. Jorgensen, Consulting Engineer, Worthington Pump & Machinery Corporation. Published by the Society of Naval Architects and Marine Engineers, New York, N. Y.

In a very practical and lucid manner Mr. Jorgensen describes the principal engineering features of the Worthington double-acting Diesel engine, for the design of which he has been so largely responsible. His treatment of the subject is unspoilt by elaboration. Confining his attention to the essential departures from the accepted practices of the Diesel engine art, which has hitherto been almost entirely the art of the single-acting engine, he relates plainly and simply how and why the distinctive features have been adopted. Excellent illustrations amplify the text.

Mr. Jorgensen belongs in the company of the marine Diesel engine pioneers. He was in charge of the engineering when the SELANDIA'S machinery was produced at the Burmeister & Wain works in Copenhagen. Harland & Wolff took him to Glasgow and placed him in charge of the Diesel engine works they started there soon after the SELANDIA completed her maiden voyage. That valuable experience he brought to the Worthington Corporation during the war and is the groundwork of the two-cycle engine development that has taken place in the Buffalo Works. Those who desire to be posted on the double-acting engine can draw their own conclusions about the interest of Mr. Jorgensen's latest contribution to the literature on the subject.

Transportation on Inland Waterways

By Brig. General T. Q. Ashburn, U. S. Army, Chairman, Inland Waterways Corp. of the United States. Published by the Society of Naval Architects & Marine Engineers, New York, N. Y.

Revival of interest in transportation on inland waterways is based upon sound economic reasons. General Ashburn states that the proponents of waterways rest their case upon three basic principles: (1) that there is not enough transportation in the United States to meet the increasing demands of the commerce of the country, that highway developments can meet only a part of it, that adequate railroad development would cost $10,000,000,000 in the next 10 years and many navigable waterways are still practically unused; (2) that water transportation is the cheapest means of transportation known; and (3) that the people as a whole, having been taxed to create navigable waterways should as far as practicable reap the benefit of the low rates inherent in such transportation.

It is probably true that the rehabilitation of common carriers upon the navigable interior waterways can only be accomplished by governmental pioneering. The Inland Waterways Corp., owned by the United States, has demonstrated on the Mississippi River the great advantages to be derived from the revival of inland waterway transportation. The Mississippi Line has indeed almost arrived at the point at which the profits are large enough to attract the interest of private enterprise. Congress has enacted that the line must then be sold by the government.

General Ashburn's paper outlines the type of equipment that should be used—arriving at the conclusion that the towboats should be Diesel driven—depots, terminals, balanced freight, interchange with other carriers and equitable division of revenue. His study of the requirements of towboats for the Mississippi River must be helpful to all those, and there is a rapidly increasing number of them, who are ordering craft of this type for the inland waterways.

Model Experiments with River Towboats. Sternwheel and Tunnel Propeller Types Compared

By Capt. William McEntee, U. S. N., U. S. Experimental Model Basin. Published by the Society of Naval Architects and Marine Engineers, New York, N. Y.

During the last year tests have been made at the U. S. Experimental Model Basin affording to some extent an opportunity to compare shallow draft towboats of different types. Very little data of an accurate source is available in regard to river craft used on American rivers.

The tests described by Capt. McEntee include three different designs of tunnel propeller towboats, and one design of sternwheel towboat. The first model was of a twin-screw boat, of 312 short tons displacement and 700 s.hp. The second model was of a boat of 1,000 short tons displacement and 1500 s.hp. The third model was of a boat of the same displacement and power as the second model, but with quadruple screws, and the fourth model was of a sternwheel towboat with 550 s.hp. on the wheel.

Tests with the model of the 700 s.hp. twin-screw towboat were made in conjunction with six model barges representing a total displacement of 3564 tons. The best propeller for these conditions was found to have a pitch ratio of 0.7, which would give a towing speed of about 6¼ miles per hour with a towing efficiency of 38 per cent, and, if the resistance of the towboat itself be included, a propulsive cöefficient of 40 per cent.

Similar tests were made with the two models of 1500 s.hp. boats, one with twin screws and the other with quadruple screws. With the propellers used the efficiency of the quadruple screw arrangement was considerably greater than that of the twin screw arrangement. The test with the model of the sternwheel boat showed that it could perform the same work as the tunnel stern boat with 650 s.hp. against the 700 s.hp. on the two propellers. Some tests were also made on rudder power, which is a very important feature owing to the manner in which the barges are handled on the American rivers, namely with the boat pushing at their stern of the barges.

Combined Streamline Rudder and Guide Vanes. Latest Development of Contra-Propellers

By Olav Overgaard, Chief Engineer, Th. Goldschmidt Corp. Published by the Society of Naval Architects & Marine Engineers, New York, N. Y.

Elongation of the vertical guide vane of a contra-propeller installation into an aerofoil shaped form comprising the sternpost and rudder is the subject of this paper by Mr. Overgaard, chief engineer of the American agents of the contra-propeller. The vertical vane is the important element in producing the increased propulsive efficiency which the contra-propeller provides. The horizontal guide vanes contribute little to the increase of efficiency, and are chiefly fitted because they tend to eliminate pitching of the vessel. By streamlining the rudder the flow of water past it is less disturbed, and the eddying is largely eliminated. The streamlining of the rudder is not a very expensive matter. The rudder plane and gudgeons are enclosed in a shell built up of ¼ inch to ⅜ inch plates and shaped so as to form an extension of the guide vane curves. Oak ribs are fitted between the rudder and the plating, and the hollow spaces filled with asphalt to prevent corrosion. This combination of a streamline rudder and guide vane is a rational development of the contra-propeller.

A Simple Method for Designing Propellers

By Rear Admiral C. W. Dyson, U. S. N. Published by the Society of Naval Architects & Marine Engineers, New York, N. Y.

Although the author states that the object of this paper is to clear up the objection usually made against his work that it is hard to understand, because of the multiplicity of terms used, and to show by taking several problems explaining the work step by step as it progresses that the difficulty complained of is more imaginary than real, one should not understand that he brings the design of propellers within the reach of all. The subject is still one calling for a good working knowledge of mathematics.

Admiral Dyson accomplishes his object, but, in so doing, emphasizes the value of experience. In the examples he takes to demonstrate that the calculations are not very involved, he repeatedly draws upon his knowledge to furnish figures which less experienced men could not be expected to choose with such good judgment.

This fact adds force to his plea that the greatest aid to progress in the design of propellers could be supplied by shipbuilders and shipowners insisting upon accuracy in the trials of vessels built or owned by them. Trial runs should be carefully made over actually measured deep water courses; points on the curves should be determined by at least three runs for each, two in one direction and the third in the other direction; power, speed and revolution data should be accurately taken; and a model should be run to obtain the resistance curve.

Torsional Vibration in the Diesel Engine

By Frank N. Lewis, Professor of Mathematics, Webb Institute of Naval Architects. Published by the Society of Naval Architects & Marine Engineers, New York, N. Y.

Professor Lewis is widely regarded as the foremost American authority on torsional vibrations in marine oil engines. He has had intimate contact with the problem, particularly through his investigations for the Navy Department. In the paper he read before the Society of Naval Architects & Marine Engineers in New York last Fall he showed how the calculation of the natural frequencies of vibration is made, dealt with the calculations of vibration in multicylinder engines, proceeded to review the various types of engine installations and their vibration characteristics, and concluded with a review of the possibility of eliminating vibrations.

Professor Lewis has previously read papers on Torsional Vibration, but this is the first one

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in which he deals exclusively with these vibrations as they occur in Diesel engines. He gives two actual examples of calculations in connection with existing American vessels. One example deals with the War Department Diesel-electric hopper dredges in which trouble was encountered through crankshaft failures. The calculations are shown for the original shafting arrangement and for the revised arrangement of shafting. When the vessels were originally commissioned the engines had a critical exactly at the operating speed. By increasing the diameter of the crankshaft and of the generator shaft and by shifting the flywheel closer to the engine the critical was raised 35 revolutions, and the engines now run very smoothly and entirely free from dangerous criticals.

The second example deals with the torsional vibration characteristics of the motorship SEEKONK converted by Wm. Cramp & Sons Ship & Engine Building Co. in 1923. In the engine of this vessel it is shown that there is no important critical within the operating range.

Professor Lewis specially emphasizes the following points:—The critical speeds depend not on the engine alone, but on the engine and all machinery driven by it. The successful performance of an engine in one installation so far as vibration is concerned, is no guarantee that it will be equally successful in another. Whether an engine does or does not develop serious vibration on the test stand is no criterion of what its performance will be when driving its actual machinery.

Cam Control of Diesel Engine Fuel Measuring Pump Suction Valves

By Lieutenant J. E. Canoose, U. S. N., Navy Yard, New York, and F. P. Porter, Navy Yard, New York. Published in the Journal of the American Society of Naval Engineers, Washington, D. C.

For simplicity sake group control is almost universally used in the fuel measuring pump group of Diesel engines. How far this falls short of the requirements of submarine engine operation has been the subject of prolonged study at the Brooklyn Navy Yard. Lieut. Canoose has published several articles about his researches. The latest article is devoted to his examination of the extent to which cam control can remove the shortcomings he has found and measured in the conventional type of pump. Much of the article is abstruse, but a great deal of it can be understood and profitably absorbed by anyone who has a more than elementary knowledge of the functioning of fuel pumps.

Centrifugal Compressors for Diesel Engines

By Sanford A. Moss, Engineer, Mechanical Research Department, General Electric Company. Published by the American Society of Mechanical Engineers, New York, N. Y.

With the exception of articles that have appeared in this magazine there has been practically nothing published in this country on the use of centrifugal compressors for scavenging and supercharging of Diesel engines. Mr. Moss, in a paper read at the annual meeting of the A. S. M. E. at the beginning of last month, therefore took the opportunity to make a general review of the whole subject and of the accomplishments to date both here and abroad. He has covered the field very effectively.

The General Electric Co. first made contact with the use of centrifugal compressors in its researches into the problem of supercharging Liberty aeroplane engines. It devised a very efficient and exceedingly light unit driven by the exhaust gases which now seems to be standard in the aviation service. From this it has proceeded to its studies of centrifugal compressors for Diesel engines.

Mr. Moss indicates that he has been making experiments with an exhaust gas turbine for driving these centrifugal compressors and thereby making a still further saving of weight and space than is already obtainable with the electric driven type. Comparing the scavenging blowers of the centrifugal type fitted on the BENSON FORD and HENRY FORD II with the reciprocating type on motorship CHALLENGER, Mr. Moss states that the net saving of weight was about 4½ per cent of the machinery weights and the saving of length in the machinery about 13 per cent. With the centrifugal compressor and exhaust turbine wheel running at 10,000 to 20,000 r.p.m., the saving in space and weight would be even greater.

Mr. Moss endorses the opinion we have frequently expressed that the rational application of supercharging to 4-cycle engines will result in considerable gains in thermal efficiency and power for a given engine weight and will help to reduce the price per horsepower.

Auxiliaries for Motor Vessels

By John W. Morton, Engineer-in-Charge, Diesel Department, New York Shipbuilding Corp., and A. B. Newell, Guaranty-Engineer, New York Shipbuilding Corp. Published by the American Society of Mechanical Engineers, New York, N. Y.

As an example of the value of cöoperation in the preparation of a technical paper, this contribution of Mr. Morton and Mr. Newell is very interesting. The former reviews the alternative styles of auxiliary installations in motorships with a comparison of operating costs, while the latter adds comment on the practical operation of auxiliary machinery.

Dealing with the relative costs of steam auxiliaries and electrically driven auxiliaries the paper sets out in considerable detail the conditions on two different vessels, one of 2000 tons d.w. with 1100 b.hp. main engines, and the second a vessel of 10,000 tons d.w.c. with 2250 b.hp. The maximum horsepower of the driving units and the various loads at sea, maneuvering and in port given in these tabulated comparisons are the best we have yet seen. The saving in fuel cost per year by the use of electric auxiliaries in both cases is very considerable.

A very effective comparison is furnished by the figures for the motorship CUBORE and for steamers of about the same size, some with reciprocating engines and some with turbines, operating on exactly the same schedule and under the same conditions. The total fuel consumption at sea is not segregated for main engines and auxiliaries, but it represents about three times as much in the case of the steamers as in the case of the CUBORE. In port the steamers burn 20 times as much fuel as the CUBORE uses. Figures are quoted for the SEEKONK and for the ASHBEE, showing in the case of the former a cut to nearly ⅛ and in the case of the latter a cut to better than 1/5 since the ships have been converted from steam.

A very thoughtful analysis is made of the subject of air compressors and air storage. These matters are among the most important to be determined in the selection of auxiliary machinery, and the treatment which Mr. Morton gives them is very well considered. He appends a useful table of air storage data on 22 Diesel engine installations.

Some of Mr. Newell's remarks are very trite. For instance, that whereas in steamers reduced fuel consumption per i.hp. is generally accompanied by an increase in the number of auxiliaries, on the other hand, in motorships reduced fuel consumption is generally found to go hand-in-hand with the reduction in the number of auxiliaries. Another remark of his worth quoting is—"The tendency now is to follow more mature experiments from Europe with certain modifications which we may call Americanization." We may not be original, but we have a certain individuality.

A Prophetic Poem of 1904

Lord Inverforth, the erstwhile Andrew Weir, founder of the Bank Line which has 21 motorships in service and on order, is President this year of the Institute of Marine Engineers, London. His inaugural address was devoted to an exposition of motorship development, and in concluding it he offered the following poem composed by his friend William Blane in 1904 and remarkable for its prophetic vision.

THE PASSING OF STEAM

Muffle the drums of progress—
  Their roll of triumph and doom!
Let the doors awhile be shut in the street
While Science and Art, with reluctant feet,
  Bear a giant to the tomb—

The engine that Watt invented,
  That Stephenson put on wheels,
That Fulton harnessed to furrow the seas
And circle the globe with titanic ease
  On a hundred thousand keels.

I smiled at Internal Combustion—
  Producers and gas and oil;
Their faithless ignition, their odor and jar,
By-products of sulphur, ammonia, tar,
  High tension, magneto and coil.

For a row of chain-stoked boilers,
  Welsh coal and super-heat,
Triple expansion, true lap and lead,
Vacuum steady and constant speed,
  Will foster a fine conceit.

From furnace front to discharge pipe
  It's a living, throbbing thing—
A living, throbbing thing, with a soul,
Which a fiend might fear and a child control,
  And the fabled Muses sing.

But, reckoned in calorifics,
  Internal Combustion wins,
For twelve per cent. of the B.T.U.
Is the best, in effective work, we do,
  And with twenty gas begins.

What though it wrought such wonders
  In the space of a hundred years!
Before a question of L.S.D.—
The cost of a Unit or B.hp.—
  All sentiment disappears.

Hark! 'tis the knell of its passing—
  The end of the reign of Steam!
And sad, like a lover whose jealous eye
Confesses the truth he would fain deny,
  I follow as in a dream—

Follow and dream of problems
  Of balance and power and speed;
Of what will equal the final *x*
When thermo-dynamics no more perplex
  And the wish commands the deed—

Of nature and art and science,
  Of thought and desire and will,
Of energy and its primal source,
Or motion without a moving force
  And the power of being still.

A dirty engine room bespeaks the character of the man responsible for it.

Foresight indicates that advantage has been taken of hindsight and that the latter is essential. However that does not excuse anyone awaiting the acquisition of the latter before practicing the former.

The man who talks too much annoys us, but when he always uses the first person singular we just simply can't stand it.

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Sketches and Working of Oil Engines*

Trunk Piston Operating Conditions and Lubrication. Avoidance of Seizures and of Scoring. Importance of Timing Piston Lubrication.

FROM the discussion of trunk pistons which formed the subject of the preceding chapter, many students will already have drawn some inferences on the working and lubrication of this most important engine part. It will have become apparent that the structure of a trunk piston and the conditions under which it operates have a special bearing on its lubrication.

Although the main load coming on the piston acts in the direction along its axis, and although only a relatively small fraction of this load is converted into sidewise pressure, the lubrication of trunk pistons requires somewhat more careful attention than that of other engine parts for two reasons.

These are that the fitting of the piston with clearance, as well as other factors causing an imperfect mechanical fit between the piston and the cylinder liner, tend to break down the lubricating film and that the high temperatures of the piston and cylinder surfaces lower the viscosity of the oil to a greater degree than is the case with plain bearings not running in contact with heated gases of combustion.

The film, or capillary skin of microscopic thickness, which the oil is intended to interpose between the sliding surfaces of contact is ineffective unless its thickness be maintained at a fairly definite figure. Too thick a layer of oil, will, of course, support nothing, and too thin a membrane will be broken through by metallic contact. In the case of ordinary bearings or of sliding surfaces operating at normal temperatures, ordinary machining methods are accurate enough to prevent the formation of excessively high or low spots. The projecting parts are not high enough above the average surface to rupture the film and the low parts are shallow enough to permit the establishment of a tough capillary oil film within them.

In the case of a trunk piston running at fairly high temperature and subjected to distorting influences, the high spots may be exaggerated to the point of causing a rupture of the oil film while the low spots do not carry their share of the load. A well-maintained oil film can carry as high as 5000 lb. per sq. in., but when this figure is exceeded as the result of localized pressures produced when the piston assumes other than a cylindrical shape the lubrication is apt to break down. High temperature further increases this tendency, and the contamination of the lubricating oil resulting from the leakage of combustion products past the piston also contributes its share to the impairment of lubricating efficiency.

Reference to Fig. 109 shows what may be considered a microscopic section of the clearance space between the piston barrel and the cylinder in which it works. The high spot is there shown in the act of nearly breaking through the oil film, while the low spots are correspondingly taking a smaller fraction of the load. So long as no metal-to-metal contact takes place, there will be no danger, as is the case with the great majority of trunk pistons now in successful operation.

Aside from the purely local high spots found on any accurately machined or even polished surfaces, the piston may produce high areas of considerable extent resulting from deformation in the piston body as a whole. An exaggerated illustration of this is shown in Fig. 110, which purports to be a flat slide moving on a rigid lubricated surface. As the two webs through which the load from the gudgeon is transferred to the flat plate are localized, the oil film pressure at these points is correspondingly high, while the rest of the plate, not being so well supported, deflects and allows the oil film pressure to drop correspondingly. The dotted line shows how the oil film pressure would vary in the case of a perfectly rigid block in which no sensible deflection could take place.

When the film is ruptured this occurs at one or more high spots at which the film is initially very thin. With a considerable increase of load near these areas, or a weakening of the film due to high temperature, metallic contact is established, and as far as the particular area is concerned the oil film ceases to function.

An example of how this may occur is illustrated in Fig. 109 where a piston with radial webs is sketched. As the piston shell does not possess nearly as much rigidity as the webbing, the latter throws the cylindrical contour out of shape and causes the formation of high spots directly opposite each web. Consequently those portions of the piston shell situated between the webs cease to take an adequate share of the load, while the ridges caused by the webs bear hard.

If the film area existing under these ridges is taken as a basis on which to figure intensity of bearing pressure, it will probably be found that film pressure far in excess of 5000 lb. per sq. in. over the limited area in question have been set up. As the oil is not capable of carrying such a load the film breaks down and metallic rubbing contact is established.

Much the same thing occurs when a cylinder liner is fitted too tightly. Localized high spots are then formed at those diameters situated opposite the tight fits of the liner within a jacket, and if these are micrometered after the piston has been running for a time it will be found that the metal in those areas has been excessively worn as indicated in the sketch (Fig. 109).

It is, therefore, essential that cylinder liners be loosely fitted in order that the expansion attendant upon the normal rise in temperature shall not cause bulging and hard wear at the points indicated. No liner should be so fitted that it will not drop into place of its own weight.

A general estimate of the intensity of bearing pressure may be based on the assumption that the maximum value of the side thrust equals one-tenth the maximum direct thrust imparted to the piston by the gas pressure. If its diameter be taken equal to D and the pressure assumed to be 500 lb. per sq. in., then T, the straight-line thrust, may be written

$$T = \frac{500\,\pi\,D^2}{4}$$

while t, the side thrust causing friction between the cylinder wall and the piston, may be set down as

$$t = \frac{500\,\pi\,D^2}{40}$$

Now it will generally be found that the total length of a trunk piston varies between $1.5D$ and $2D$. In a calculation set up purely for illustrative purposes no serious error will be made by placing the length of the piston equal to $1.5D$. Its area projected sidewise (in the case of a vertical engine) will therefore amount to D x $1.5D$ or $1.5D^2$ sq. in. If, then, the value of the side thrust t in pounds be divided by this number of square inches the value of p, the intensity of side pressure is found to be

$$p = \frac{500\,\pi\,D^2}{40 \times 1.5D^2} = \frac{500\,\pi}{40 \times 1.5} = 26 \text{ lb. per sq. in.}$$

It is to be borne in mind, of course, that the figure of 26 lb. per sq. in. of projected piston area is nominal only. The ring part of the piston is not available to take any side load because it must be heavily relieved in order to prevent the tops of the ring grooves from touching. That part of the piston situated between the wrist pin hole and the lower groove should preferably be made as large as possible in order that the side thrust laterally transmitted through the center of the piston pin may be supported on both sides. The designer is, of course, tempted to reduce this length as much as possible in the interest of lessening piston weight and reducing engine height, but caution needs to be exercised if the effective bearing surface is not to be too seriously reduced.

Other factors tending to reduce the actual rubbing contact surface below that represented

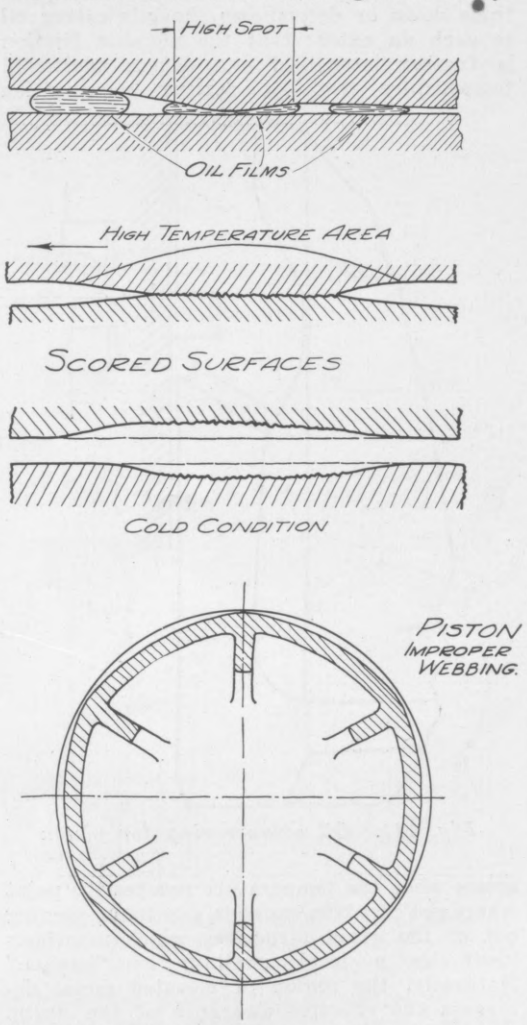

Fig. 109. Sketch of piston lubricating conditions

*Summary of a Course of Instruction at the Polytechnic Institute of Brooklyn, N. Y., by Julius Kuttner, B.Sc., Licensed Chief Engineer, Editor of OIL ENGINE POWER and Associate Editor of MOTORSHIP. This is the eleventh chapter, the first one having appeared in the January, 1925, issue.

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by the projected piston area are the clearance necessary for running. As already discussed in the previous chapter, this clearance is produced by turning the piston to a smaller diameter than that of the liner bore. The piston, therefore, theoretically touches the liner only on a single contact line. Naturally, the contact surface is larger than this, but is by no means equal to the projected piston area. Finally it is to be remembered that only those portions of the piston substantially parallel to the wrist pin really take any load while those areas parallel to the direction of side thrust are as good as useless.

Because of these facts there is a practice in some engine building shops to allow the piston to bed itself in by actual running. After the engine has been assembled on the test floor for the first time, it is started up and allowed to run for a short time, after which the piston is withdrawn. It will be found to be touching at only a few spots; these are carefully dressed down with a file and emery, and the piston is put back for another run. After repeating these operations a few times the piston acquires a fairly well distributed rubbing surface under the conditions of temperature distortion found under actual running conditions.

Of the greatest influence in determining the wear and bearing of a piston is its size. The larger the piston the more difficult becomes the problem of keeping it in a true cylindrical shape under operating conditions, particularly if no piston cooling is provided. It is, therefore, not usual to find uncooled trunk pistons very much larger than 17 in. diameter, and some engineers place the limit at about 100 hp. as that capable of being developed in a single cylinder with an uncooled trunk piston.

Cooling pistons of this size is not altogether satisfactory, because if water is used leakage into the main lubricating oil circulating system is not readily avoidable, whereas if oil is used considerable auxiliaries in the shape of oil pumps, coolers, strainers and the like must be added to the power plant equipment. Authorities are not in full agreement as to the maximum power capable of being safely developed in an uncooled trunk piston engine. Some of them are recommending engines as big as 1000 hp., while the claim is made by others that in all sizes above 500 hp. crossheads should be used.

Scoring or seizing of a piston may be recognized by symptoms such as groaning, knocking or heavy pounding audible near the affected cylinder. This is generally accompanied by a rapid reduction in the load capacity of the engine; it slows down, labors, smokes at the exhaust, consumes excessive amounts of fuel, and, in short, shows all the signs of overloading. This condition may lead to an abrupt stalling of the engine, which in some cases has been so sudden as to cause twisting of the journals. Reasons for the extreme rapidity with which the process sometimes occurs will be apparent shortly. After the engine has stalled itself, or has been shut down too rapidly by the engineer, it may be found that the piston is extremely difficult to remove and may require a 5-ton hydraulic jack to start it.

Upon examination there will be found one or more deeply discolored patches, both on the piston and in the liner, with deep longitudinal furrows extending up and down both of them. The surfaces of the discolored patches will often be found rough and granular. Micrometer measurements show that the piston is badly out of round in a great many cases, and there will be other indications that the load has been intensely concentrated at one spot, so that the remainder of the surface has not been carrying its due share. Instead of a 15,000 lb. load being carried on the general surface of the piston, it will be found to have been carried on only a few square inches. It is obvious also from the color of the scored portions that the lubricating oil has been destroyed by the high temperature, which has been intense enough to cause the cast iron to become granular and even to fuse.

Although concentration of the load in one spot is an almost inevitable accompaniment of scoring and seizure, it may have been due primarily to lowering of the lubricating oil viscosity. A concentration of load which would not have been serious with the lubricating oil in good condition may have caused the phe-

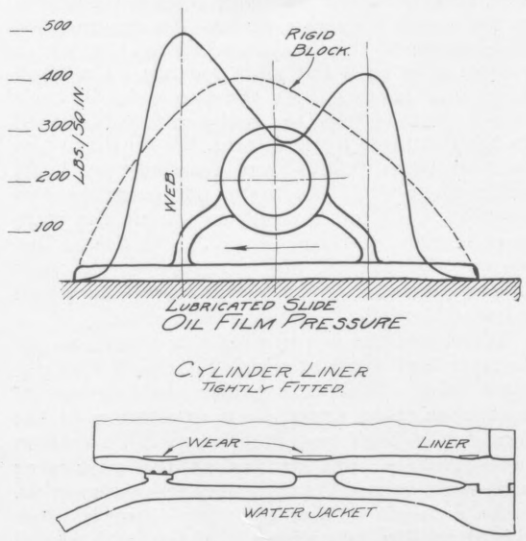

Fig. 110. Local rigidity affects wear

nomena outlined above, if the quality of the oil has been impaired either by excessively high temperatures or by other agencies such as contamination with combustion residues or fuel oil.

Probably the sequence of events taking place when a piston seizes is somewhat as follows: Metallic friction at the high spot (Fig. 109) causes a temperature rise in that area, which thins down or decomposes the lubricating oil to such an extent that the metallic friction is further intensified and causes additional temperature rise. A further complication

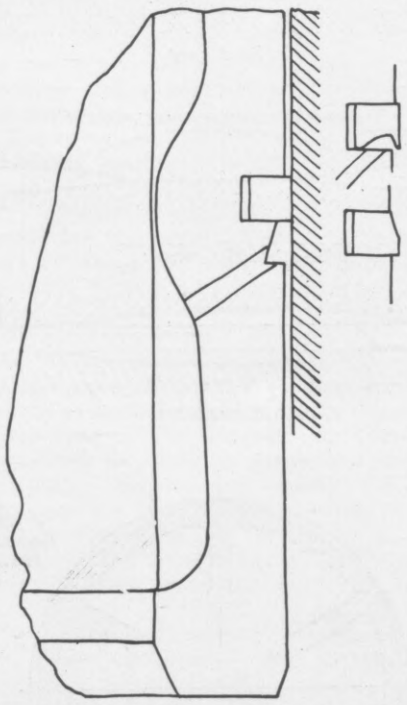

Fig. 111. Oil scraper ring for piston

arises when the temperature reaches the point where the cast iron expands, due to an opening out of the grain structure, which manifests itself by a local swelling or "bunion." Naturally, the region of elevated metal decreases the effective clearance of the piston within the cylinder, so that it bears still harder at the injured spot. The harder it bears the hotter it gets, and the more friction it causes. Because of the enormous amount of mechanical energy which is thus rapidly converted into heat over an extremely limited surface of metal the seizing action may be extremely sudden and may baffle all attempts on the part of the engineer to stave it off.

It may be a surprise to a good many to find that, after having jacked a piston out, the scored spots will actually be found lower than the remaining portions of the piston when tested by a steel scale laid over them. In order to produce the effects described, however, the spot must have bulged or been "high," and the explanation for the fact that a hollow spot is found later is that metal was removed while in the expanded condition. As the piston cooled off and returned to something like its normal shape a hollow was left in the place of the injured metal, which crumbled away unnoticed while the piston was being forcibly withdrawn.

Many operators will have observed that a piston rarely scores twice in the same spot, and that is due to the fact that the metal over that region has been removed. It is also found that the scored area has acquired extreme hardness and in many cases cannot be dressed with a file. An emery wheel is generally the only means available for dressing down those hard spots which remain standing around the scored portion like the edges of a crater around the opening to a volcano.

If a piston does not seize too suddenly an operator can do a good deal to minimize damaging results. The worst thing he can do is to shut the engine down suddenly. Many engineers are seized with panic when they observe the condition, and grab the throttle in a frantic attempt to stop the engine quickly. It is much wiser to throw the load off as quickly as possible, or in the case of an engine direct-connected to the propeller of a ship to slow it down to such a speed that it will just safely keep turning over. The next step consists in shutting off the fuel to the affected cylinder and to open up the force feed lubricators wide in order to flood the cylinder with lubricating oil while no combustion is in progress. Finally the cooling water supply leading to the jacket of the cylinder should be throttled so that just a trickle comes out of the overflow allowing the temperature of the liner walls to rise.

A sudden shut-down has the effect of allowing the scored portions on the piston liner to fuse solid. The areas thus cemented together may cause serious breakage when the piston is removed by force. Shutting off the fuel has the effect of lowering the piston temperature, because it is the crown of the piston which is most directly exposed to the heat of the frame and which is generally uncooled. Overlubricating the piston will tend to restore some of the qualities of the oil and will assist the surface somewhat in getting back to normal. Raising the temperature of the liner by throttling the cooling water will cause it to expand and give the piston a greater working clearance than it would have if the liner were allowed to cool off sharply as a consequence of cutting out the fuel. If these measures are kept in mind by the operator, serious damage may be forestalled, and in any event the work of overhauling the piston and cylinder will probably be considerably reduced.

Normally lubrication of a trunk piston is introduced through the cylinder wall and takes care of both the piston ring and the sliding friction. Splash lubrication has been used on oil engines only to a very limited extent, because of its uncertainty. While the engine is being started and brought up to speed, too little oil is thrown up by splash lubrication just at the time when there ought to be an ample supply, and when the engine has come up to speed the amount thrown into the cylinder bore is indeterminate and depends upon such factors as the depth of the oil in the crankcase and the speed of rotation. Too much oil, as will be

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apparent shortly, is just as bad as too little, and the splash method of lubrication gives the operator little or no chance to control its amount in accordance with requirements.

Cast iron pistons work well in cast iron liners. Indeed cast iron is the only metal which will wear well on itself. Bronze on bronze makes a poor wearing combination, and steel on steel is even less satisfactory. Cast iron on cast iron, however, is one of the most satisfactory running combinations known to engineers.

Trunk piston lubrication differs from that of ordinary machine parts which move in cool clean air, as the case is with a crosshead. Mention has already been made of the thinning out of the oil caused by heat and of its impairment as the result of contamination with carbon and combustion residues. Poor combustion of the fuel oil in the engine, caused either by overloading or misadjustment, yields raw fuel oil which is deposited on the cylinder walls and acts as a cutting agent on the lubricating oil. Asphaltum and pitchy substances are also left in the cylinder by dirty combustion. Little is known about the viscosity of lubricating oil at high temperatures except that it is sufficient when recognized grades such as "DTE extra heavy," "Ursa" or "Dynol Heavy" are used. The difference between them is too slight to be easily observable in practice (see Fig. 113). The actual results obtained by the one brand of oil or the other are too much obscured by a complication of other conditions such as combustion, cooling and general engine adjustment to make a definite decision possible.

No oil is proof against contamination by faulty combustion or an excessive amount of dust sucked in through the engine intakes. Poor combustion destroys the seal of the piston rings, lowers compression and raises the general cylinder temperature by after-burning. As the result of stuck piston rings the hot gases blow past them, interfere with the proper lubrication of the sliding piston surfaces, sweep out most of the lubricating oil and elevate the temperature of the remaining portion. In this case there is cumulative action again, namely the impaired lubrication reduces the sealing effect of the piston rings and lowers compression, which is followed by the poor combustion and further impairment of the lubricating qualities already referred to.

The sign of a healthy engine is clean lubricating oil found on the hand after feeling a running piston. If a black, gummy mass is found on the hand after withdrawing it from inside the cylinder, that is a sign of poor operating conditions.

Excess lubrication is partially consumed on the walls of the cylinder and deposits residues in the ring grooves in exactly the same manner as imperfect fuel oil combustion. For that reason the number of drops fed per minute for piston lubrication deserves careful watching, and is kept at between 30 and 40 drops per minute in the case of most engines. A certain amount of oil is inevitably splashed up by the crank, especially in the case of force feed lubricated engines with hollow crankshafts and connecting rods. Since this may render valueless any attempts to control the amount of oil fed by means of pressure oilers piped to the cylinder walls, some designers have fitted oil scraper rings to the lower end of the piston with a view to preventing the entrance of oil by this route. All those who have operated automobile engines know that oil is pumped, or worked, up past the piston rings in spite of the compression pressure. To guard against this, rings similar to those shown in Fig. 111 are fitted and are placed in grooves drilled to lead off the excess lubricating oil scraped down by the sharp piston ring edge. Beveling the upper ring edge will cause it to ride over the oil on the up-stroke and to scrape the oil down on the return-stroke with the sharper of the two edges. Some such arrangement as this is required to keep the cylinder reasonably free from oil not measured and controlled by the operator.

Considerable importance is attached to the proper location of the lubricating studs feeding oil into the cylinder, as shown in Fig. 112. With a trunk piston long enough to cover up the studs in all positions, this might not seem

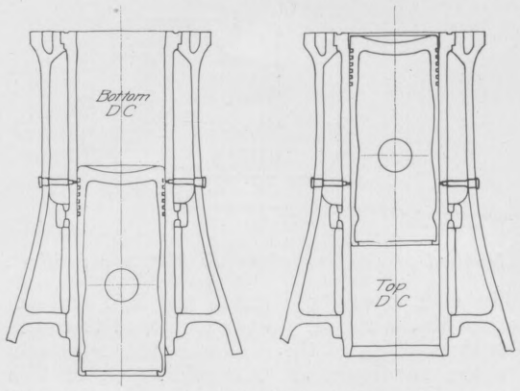

Fig. 112. Location of piston lubricating studs

to be a matter of great importance. A little reflection will show, however, that if the studs are located too far down a greater portion of the oil fed in through them is likely to be wiped out of the cylinder and lost. If the studs are located too high they will be uncovered by the piston during the lower portions of its travel, and the oil supplied through them at those intervals when the piston is in

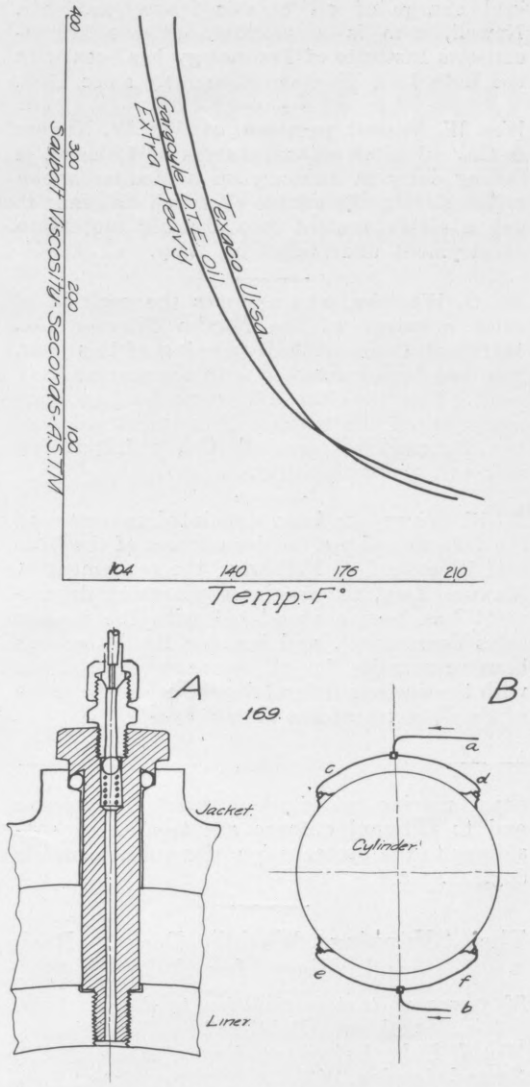

Fig. 113. Viscosity of oil and usual type of oil feed to piston

its lowermost position will be scraped up into the combustion space by the rings. In the latter case the oil is not only wasted, but also causes damage by being carbonized and fouling up the rings.

All mechanical lubricators have some kind of timing, i. e. their delivery is periodic. It sometimes happens accidentally that the frequency of oil delivery from such a lubricator differs only slightly from the motion of the piston or some multiple or divisor of it. In such cases there will be considerable periods of operation during which the oil lodges on the piston, followed by much longer periods when the oil is being spilled out underneath it. Operators conscientiously trying to adjust lubrication in the face of such a condition have been puzzled by the alternating over-lubrication and under-lubrication of the cylinder, despite accurate control of the number of drops per minute fed by the lubricator in question.

Naturally, the location of the studs as thus described takes on its full significance only if the delivery of lubricating oil is timed synchronously with the motion of the piston, so that the charge of oil actually reaches the two topmost rings when the piston is at the bottom dead center. If that is the case the oil will be partially lodged on the rings and will be carried up by them at the next stroke. It is a good plan in the case of a 4-cycle engine to arrange a timed lubricator to work synchronously with the camshaft and to have it deliver at the moment when the piston begins the upward exhaust stroke. At that time the pressure in the cylinder is only nominal and has little or no tendency to blow the oil downward. It would appear as though this method of timing has the double advantage of preventing waste of oil and of permitting a much more accurate control of its quantity than would be the case if the timing were made at the beginning of the compression stroke.

Actual tests made with timed and untimed lubricating oil delivery are said to have indicated a very substantial decrease in the amount of lubricating oil consumed when the timing is arranged for in such a manner as that described. When it is recalled that a large oil engine installation may consume between 10 gal. and 20 gal. of lubricating oil at 40 cents per day, it becomes apparent that the monetary saving due to proper attention to the timing is a considerable one. Probably the advantages incidentally obtained by the avoidance of operating troubles amount to considerably more than the monetary saving on the oil economized.

Most of the lubricators now on the market have two separate stages for handling the oil. A gravity drip or a measuring supply from an adjustable plunger working at low pressure and delivering through a sight glass deposits the oil in front of a port leading to a constant stroke plunger which forces the oil to the point of lubrication. Even though such a plunger may be accurately timed it is difficult for it to deliver the oil to the cylinder in the correct rhythm because of entrained air. Naturally the forcing plunger must always have a capacity in excess of the oil fed to it, and the air which it therefore sends along with the oil charge forms a series of elastic cushions in the lubricating oil tube, effectively preventing anything like accurate timing. It therefore seems advisable to select lubricators in which there can be no entrainment of air and which therefore can be depended upon to deliver the oil to the piston at the moment when it will do the most good.

Finally it may not be out of place to describe the cylinder lubricating plug itself. This is generally a screwed fitting, making a hard joint against the cylinder liner and more or less yieldingly packed against the water jacket. In previous chapters the explanation of the cylinder liner and its consequent motion relative to the water jacket has already been alluded to. It is therefore necessary to fit the plug in some such manner as that illustrated in Fig. 113. It will be noted in this sketch that a check valve is provided, which has the advantage of preventing gas from backing into the lubricating line and interfering with the delivery of the oil. In some standard

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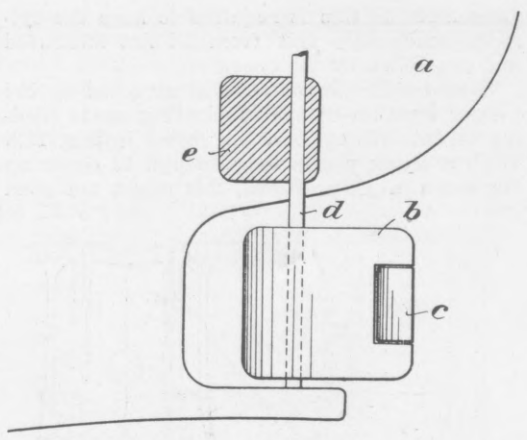
makes furnished by manufacturers of lubricating devices, the check valve consists of a long stem with a head located very close to the exit point in the cylinder. It would appear as though the latter type is advantageous, because it holds a solid column of oil right up to the point where it is needed. When the ball check shown in the sketch is used, gases may collect in the length of passage beyond it and add a certain element of uncertainty in the matter of timing.

Generally from two to four lubricators are fitted to each cylinder although in extreme cases as many as six have been used. One of the fundamental principles of piston lubrication calls for the use of a separate plunger for each lubricating opening, because if branching flow is resorted to for the sake of feeding two plugs with one lubricator, an unstable condition may readily be produced. However, in the case of cylinder lubrication it is permissible to attach two plugs to the same lubricator line providing the two legs of the branch are made equal and symmetrical as indicated in the sketch.

It is considered good practice to feed only fresh, unused oil to the pistons, although there seems to be no reason why centrifugally purified oil should not give satisfactory results. As is the case with a good many other details of oil engine operation, cleanliness is the key to success. If this idea is made a matter of conviction with the operator, not only as regards the condition of cylinder lubricating oil, but also as regards cleanliness of combustion, the application of the points brought out in this chapter should give no difficulty.

Counterbalance for Rudders

A means for counterbalancing the weight of a large Flettner rudder is shown in U. S. Patent No. 1,550,955 granted to Anton Flettner of Germany and issued recently. Balanced rudders are, of course, not new, but in the case of the Flettner rudder, where a small pilot rudder is utilized for the purpose of diminishing the power required for steering, the balancing systems heretofore used do not seem to be applicable. When the surface of a large rudder is not symmetrically disposed about the rudder post and its mass center not located in the axis of the rudder post, there will naturally be unbalanced forces due to gravity when the vessel is not in an upright position. These forces are generally opposed by the self-locking arrangement of the ordinary steering gear. In the Flettner rudder the large steering engine and gear are suppressed. Flettner, therefore, proposes to use counterbalanced masses. For instance, in the accompanying illustration *a* is the stern of the vessel and *b* is the rudder operated by an auxiliary or pilot rudder, *c*. The main rudder *b* is partly balanced by the extension of the rudder surface forward of the rudder post *d*.



Method of counterbalancing Flettner rudder

The counterweight *e* inside the hull and secured to the rudder post is employed to equalize the weights of the rudder system relatively to the rudder axis. A modification of this arrangement is to place the counter weight inside the rudder and another modification proposed is to provide sufficient hollow space in the after part of the rudder so that the forward end of the rudder will need only a lighter counterweight.

Personal

William S. Newell, for several years works manager of the Bath Iron Works has joined the firm of Cox & Stevens and will have general charge of all outside inspection. Mr. Newell, who is a graduate of the Massachusetts Institute of Technology has been with the Bath Iron Works continuously since 1902.

Wm. W. Nugent, president of Wm. W. Nugent & Co., oil filter manufacturers of Chicago, is sailing early in January on a Mediterranean cruise during the course of which he plans to get a closer insight into the big motorship development undertaken by Italy.

W. O. Whitney, who assumes the position of sales manager of the Maxim Silencer Co., Hartford, Conn. at the beginning of this year, has long been connected with the marine business. For the last 10 years he has been manager of the marine department sales of the Brunswick-Kroeschell Co., refrigerating machinery manufacturers.

D. W. Niven has been appointed manager of the federal and marine department of the General Electric Co. Following the retirement of Maxwell Day, the marine engineering department has been consolidated with the marine sales department, and because the latter has been responsible for all company negotiations with the various federal departments the name of the department has been changed.

Civil Service Vacancies

New York Navy Yard needs immediately additional draftsmen for designing, detailing and copying. Rates of pay are $8.08 to $10.16 a day for design draftsmen, $5.84 to $7.60 a day for detail draftsmen and $4.64 to $5.04 a day for copyist draftsmen. In addition to mechanical draftsmen, men are needed with experience on structural steel, ship piping and ship ventilation. Applicants will not be assembled for written tests, but will be rated on their education, experience, fitness and specimens of work. Application blanks may be obtained from the Secretary of the Second U. S. Civil Service District, Custom House, New York City.

Catalogs

Bessemer Marine Diesel Engines—48 pp., describing the design of the Bessemer oil engine and containing dimension prints of the sizes of engines made by the company. Bessemer Gas Engine Co., Grove City, Pa.

General Electric Catalog 6001*B*—1100 pp., superseding all previous catalogs issued by the Company, with the exception of those dealing with railway, mine and industrial supplies and merchandise products. General Electric Co., Schenectady, N. Y.

Pyrometers. Catalog Part 4000. A 56-pp. descriptive catalog of thermo-electric pyrometers and recording pyrometers such as may be used for measurement of exhaust gas temperatures. Taylor Instrument Companies Rochester, N. Y.

We have heard that tools do not make the mechanic. Neither does water make a ship, but what good would she be without it?

To be more sure of a man's ability than of his friendship is a good basis upon which to recommend him for a berth.

When a try plug in the exhaust pipe is stuck fast, that is conclusive evidence the exhaust gases have not been watched closely enough.

Review of Latest Technical Books

(*Continued from page* 40)

countries of the world to the shipping under their respective flags. Book III is a post-mortem examination of American shipping during the war and armistice periods, and a rather doleful examination of the prospects of American shipping from the point of view of one who apparently believes that an American merchant marine will only be firmly established when the economic conditions of this country are changed—seemingly for the worse. The authors acknowledge reprinting in this book articles that have been published in full or in part in the *Quarterly Journal of Economics,* the *American Economic Review,* the *Journal of Political Economy, Foreign Affairs,* etc. That seems to explain why in this book the importance of the American merchant marine to American foreign commerce and to national defense are treated as subsidiary to the preservation of certain economic dogmas.

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